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ABSTRACT

This manual is designed to assist communities in recycling the greatest possible volume of materials in ways which will: (1) benefit the local economy; (2) encourage cooperation between public and private sectors; and (3) prove valuable to municipal and county sanitation services. The manual is divided into five sections. Section 1 lays out the "why" of recycling: the positive impact on energy conservation, savings in landfill space, potential income for recycling groups, and other benefits. Section 2 discusses how and why the Clean Community System (CCS) is appropriate to recycling. Section 3 discusses program development, addressing how to identify markets, how to establish collection practices, and how to gain public support. Section 4 states considerations for the actual recovery of such materials as aluminum, paper, glass, plastics, and steel. It also includes a section on composting of household wastes. The final section of the manual includes appendices. The first is an outline for creating a recycling center, based on Owen-Illinois' "Recycling Station," the first theme-center for recycling, where graphics and equipment tie into a railroad motif. Other appendices include a glossary, recycling equipment suppliers, recycling organizations, and a list of Keep America Beautiful members and background on the CCS. (JN)

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Clean Community System Multi-Material Recycling Manual

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Foreword

Public awareness and commitment to recycling "waste" materials in the United States of America have long been accepted foundations and principles.

Keep America Beautiful, Inc., dedicated to the public interest, supports and encourages the recovery ethic that has already been well established in our country.

Reclaiming materials is of major interest and importance to all of our citizenry. As a public service, Keep America Beautiful, Inc. has prepared this Multi-Material Recycling Manual, including sections on:

I. Why recycle?, principles of successful efforts.

II. How the Keep America Beautiful, Inc. CLEAN COMMUNITY SYSTEM provides a conceptual structure for recycling.

III. Considerations for local leaders to use in developing multi-material recycling programs.

IV. Background on recovering various types of materials, and working with established operations in these areas.

V. Appendices — Case Study on "Recycling Centers" - Glossary - Equipment - Organizations Involved in Recycling - Members of Keep America Beautiful, Inc. — Summary of the CLEAN COMMUNITY SYSTEM.

The purpose of this manual is to assist communities in recycling the greatest possible volume of materials in ways which will:

- benefit the local economy
- encourage cooperation between public and private sectors
- prove valuable to municipal and county sanitation services

Success in achieving these three objectives will rest on a good working relationship between program leaders and local industries, and may or may not include creating a "recycling center."

Program leaders should bear in mind that this manual does not seek to show how multi-material recycling programs must be run — but rather, it lays out considerations for doing so.

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American Paper Institute, Inc.
The Continental Group, Inc.
National Steel Corporation
Owens-Illinois, Inc.
Reynolds Metals Company

And the thoughtful guidance and suggestions provided by these associations in writing sections dealing with their industry and/or reviewing the completed draft:

American Iron and Steel Institute
American Public Works Association
The Institute of Scrap Iron and Steel, Inc.
National Association of Recycling Industries
The Society of the Plastics Industry, Inc.

I. OVERVIEW

Introduction

As a nation we dispose of about 150 million tons of waste each year. Every day, each American discards an average of four pounds of such waste. Through effective multi-material recycling programs, communities can decrease the amount of municipal solid waste that enters their landfills and simultaneously generate substantial revenue.

This relatively low-cost, low-technology alternative can be found in recycling, which has been conducted on a major scale by scrap collectors and processors since the advent of the Industrial Revolution. Examples of grass roots recycling programs abound since the late 19th century.

A. Why Recycle?

As a waste management process, and in other ways, multi-material recycling can:

1. Demonstrate Community Commitment to Environmental Preservation and Energy Conservation

   A multi-material recycling program can create civic pride and a feeling that the community is doing something to improve the quality of life.

2. Conserve Landfill Space

   Many urban areas are in danger of running out of land disposal areas. For each pound of material that is recycled, landfill space is saved.

3. Conserve Energy

   Making new products from recycled materials, in most cases, saves energy otherwise used in the extraction, transportation, and manufacturing processes of products made from raw materials.

4. Conserve Natural Resources

   Recycling reduces demand for both foreign and domestic raw materials.

5. Can Generate Revenue

A well-run program can generate income — by selling recyclables previously buried or burned.

B. Principles

There are two key principles which must be understood by community leaders seeking to establish successful multi-material recycling programs:

1. Recycling begins when materials are bought and sold. Industry buys recyclable material when it is needed, not because it is available. All recycling programs are subject to constraints imposed by scrap materials markets in their vicinities. These programs cannot be insulated from the normal demand-supply fluctuations of the marketplace. Even though tons of glass, paper and cans may be collected, there must be a demand for the waste at a price that will at least cover transportation and sorting costs. It should be anticipated that fluctuations in demand or supply will inevitably result in fluctuations of price, and, in a free market, such fluctuations never stop.

2. Source separation of materials from municipal solid waste prior to collection and/or recovering materials from solid waste after collection and transporting them to a recycling center or a waste dealer's plant is the first step in recycling, but not the entire process. Recycling occurs when the material is returned to a manufacturing plant where it is made into a new product. This new product will not be made unless there is a demand for it in the marketplace.

In addition, community leaders will want to note that:

1. This manual deals with the recycling of post-consumer wastes — i.e., material that has gone through its useful life and served the purpose for which it was intended. Therefore, industrial waste (waste material generally discarded from industrial operations or derived from a manufacturing process) is not included in this manual.

2. While this manual is based on organizing techniques proven successful through the Keep America Beautiful, Inc. CLEAN COMMUNITY SYSTEM, use of it is

not restricted to CCS cities. Conversely, CCS cities should consider this manual as a resource in program development; recycling is not a required part of their CCS efforts.

II. THE CLEAN COMMUNITY SYSTEM AND RECYCLING

KAB's CLEAN COMMUNITY SYSTEM improves the handling of waste by reducing littering and encouraging recycling; it relies on the involvement of people. KAB's experience at involving the people has led the organization to develop a comprehensive approach to recycling, reflecting KAB's unique role as the public service mechanism through which recycling industries have made their commitment to broadening citizen understanding about solid waste. Since 1953, its "people programs" have been the cornerstone of KAB's growing success. Its visibility increased with Lady Bird Johnson's campaign in the mid-1960's and the adoption in 1970 of the "Crying Indian," Iron Eyes Cody, as KAB's symbol in public service advertising. Perhaps no single effort has made KAB more qualified to deal with recycling, however, than the nationwide growth of the CCS.

CCS is a behavior-based approach to changing people's attitudes and practices about handling waste. It was created specifically to respond to the needs of communities across America for a comprehensive, business-like plan to reduce litter and sustain its reduction. Three years of research preceded the national rollout of CCS in 1976. Since then, more than 300 cities and counties in 38 states have met CCS certification standards. Litter in these communities has been reduced by as much as 80% — and sustained at those levels as long as six years.

CCS reduces littering by involving the entire citizenry in, first, achieving a consensus that a litter problem does exist and is solvable through voluntary action and, second, reaching out to business, labor, civic groups, media, schools and government to implement an ongoing program based on updated sanitation ordinances, improved technology, continuous public education and consistent enforcement of local laws.

The sophistication and comprehensiveness of CCS has had many benefits to certified communities. Initially, of course, litter reduction spurs the community to further action and a growing sense of pride in achievement. Over time, communities are able to register substantial cost-savings to local government from CCS. In a Cost/Benefit Analysis of CCS cities funded by the Lilly Endowment and carried out by the American Public Works Association in 1981-82, it was found that, for each municipal dollar invested in the CCS, a community receives from $2 to $111 in benefits. This far exceeds today's common acceptance, among public officials, of a break-even

cost/benefit ratio as justification for continued public funding. The "payouts" to a community include budget reductions, the ability to provide community improvement services for items not able to be budgeted, increased efficiency in solid waste collection and disposal and, significantly, the "profitability" of recycling — particularly to the extent that litter reductions will increase the availability of recyclables.

But perhaps the greatest benefit of CCS to communities is the heightened citizen understanding of sensible approaches to solid waste management, the appropriateness of public involvement in the educational aspects of it, and the limited resources of municipal and county governments to deal with solid waste. Litter — and refuse in general — tends to be a highly emotional issue. The fact-finding and breadth of involvement which underlies CCS defuses this emotionalism and replaces it with a new community institution — the "Clean City Committee" — which has the public's trust and cooperation.

Many of these Clean City Committees have found, often in the second or third years of CCS implementation, that there is growing support for expanding their area of activity into recycling. As the public begins to understand more about solid waste, people begin to see the interrelationships between the refuse that lies on the street as litter and that which becomes "invisible" when the trash collector takes it away (only to become a problem again when disposal space becomes scarce and the community looks to site a new landfill). More than half the CCS programs underway at least one year have broadened their efforts to include recycling. Several, recognizing the comprehensiveness of CCS, have established special task forces to examine the feasibility of resource recovery including materials recovery and energy recovery from solid waste operations.

In all CCS communities, great care is taken to delineate between the different (and sometimes contradictory) natures of reclaiming "waste" materials. They come to understand "recycling" as, fundamentally, a low-technology process of collecting used items, categorizing them by type of material (glass, paper, aluminum, etc.) and selling them to companies which then re-process them, generally as the same material. Sometimes, communities will establish "collection centers." "Resource recovery," on the other hand, signifies a high-technology process in which unsorted municipal waste is separated by air, magnetism, etc., the recyclable materials reclaimed, and other materials put to another use, such as the generation of energy.

Judging by the level of activity to date, both in CCS cities and elsewhere, recycling seems to be taking precedence as an alternative to disposal of solid waste. As a national public service organization, KAB continues to encourage every community to examine for itself the various approaches to solid waste management and select those which best meet its own needs and available resources. Indeed, this manual grew largely from repeated requests from local officials to provide guidance in answering the question, "What do we do with the litter after we clean it up?"

In that regard, KAB cautions every community considering recycling to first get the facts about the situation — most importantly, to identify appropriate companies and industries now in the community, county or region and involve them in designing a recycling program well suited to the area. Too often, well-intentioned individuals spend substantial time and effort to open "recycling centers" in their communities, only to find that recyclers from industry (glass, paper, aluminum, other ferrous and nonferrous metals, plastics, etc.) already had full-time operations and were doing the job more efficiently, but were looking for assistance in sustaining their markets. (In fact, the opening of citizen-sponsored "recycling centers" might cut into these markets, thus hurting the industries while not even replacing them with equally well-run citizen operations.)

The public and private sectors each have an important role in recycling, and a lasting system must involve both groups. The private sector has the technology and managerial know-how to do the actual recycling. The public sector can facilitate the program development that involves residents, local businesses and institutions, educate the public about the advantages of multi-material recycling and provide the kind of "positive reinforcement" that will sustain public interest, apart from the payouts to the clubs and individuals who take part.

This cannot be stressed too strongly. <u>The best use of public resources in encouraging multi-material recycling will come mainly from working with recycling businesses in the community and working out the most efficient collector system.</u>

Public agencies and organizations have a unique capability to develop and sustain multi-material recycling programs. Instead of the disappointing experience many communities have faced when the initial flurry of citizen activity dies down, communities that work with existing recyclers will have a "win-win situation." The increased volume

of recyclables will make these companies more profitable, thus allowing them to create new jobs within the community. And the civic groups will not only increase the volume of materials being recovered, and have the potential for producing income for other projects through the sale of recycled materials, but will have the satisfaction of getting the job done in a way that benefits everyone.

III. MULTI-MATERIAL RECYCLING - PROGRAM DEVELOPMENT

As has been indicated (and explained more fully in Appendix VI), the CLEAN COMMUNITY SYSTEM is built upon local decision-making and cooperation between public and private sectors for the common good. Whether applied to litter control, recycling or other community concerns, the CCS must be adapted to the needs of the community, based on its own unique situation.

The purpose of this section, therefore, is not to provide a "blueprint" for the development of multi-material recycling programs. Rather, topics will be discussed for local leaders to consider in creating these programs. Neither Keep America Beautiful, Inc., nor any other national entity, could give facts that would be true for every community — but KAB, through this manual, will help you get facts that will provide a body of knowledge from which a successful effort can develop.

Several conclusions, however, can be drawn from experiences across the nation. Each should be recognized by those developing the multi-material program:

1. All recycling programs are subject to constraints imposed by scrap materials markets in their vicinities. These programs cannot be insulated from the normal demand-supply fluctuations of the marketplace. Even though tons of glass, paper and cans may be collected, there must be a demand for the waste at a price that will at least cover transportation and sorting costs. It should be anticipated that fluctuations in demand or supply will inevitably result in fluctuations of price, and, in a free market such fluctuations never stop.

2. Communities should give equal consideration to the advantages and disadvantages of voluntary and mandatory curbside collection of recyclables. While mandatory collection will initially provide a larger volume of recyclables, it also violates the principles of voluntary action that have sustained public enthusiasm and involvement in successful community-based programs.

A. Markets & Market Arrangements

Collecting recyclable materials does not guarantee their reuse. A demand for them must exist. This demand depends on the availability of substitute materials,

industry's capacity to use reclaimed materials, the state of the economy, energy costs (affecting whether it is more economical to manufacture from virgin materials or recover used materials), and the "purity" of the collected recyclables.

Each potential buyer of collected reusable materials will have certain specifications regarding how he must receive these materials. General guidelines about each industry's requirements are laid out in Section IV.

Those considering a multi-material recycling program should conduct a market study as its first order of business. The first step is to locate the area's available markets for recyclable materials. A program may then be planned according to what materials these markets will and will not buy. Check the yellow pages under "Recycling," "Junk Dealers," "Salvage Companies," "Waste Paper," "Scrap Iron and Metals" and "Secondary Dealers." Various trade association magazines may also indicate additional buyers. During initial contacts with potential buyers, program developers should ascertain current price ranges for their recyclables and determine if the buyer or the recycling program would be responsible for hauling the collected materials. After available markets have been located, the next step is to work with the buyers to calculate the approximate quantity of materials the community expects to have for sale. Working together, buyers and program developers can determine the quality specifications of the buyer, shipping and hauling arrangements, contract options, and other requirements which the municipality and the purchaser must meet.

Program developers may wish to use Table I to examine the percentage of municipal waste resulting from the discard of particular types of products. It may be more appropriate, however, to secure comparable information from state or county sources.

TABLE I

COMPONENTS OF MUNICIPAL SOLID WASTE, 1975*
(Based on wet weights)

Product	% of total waste generated	
Durable goods		10.9
Major appliances	1.8	
Furniture, furnishings	2.5	
Rubber tires	1.3	
Miscellaneous durables	5.3	
Nondurable goods, excluding food		17.8
Newspapers	6.5	
Books, magazines	2.3	
Office paper	3.8	
Tissue paper, including towels	1.6	
Paper plates, cups	.4	
Other nonpackaging paper	.8	
Clothing, footwear	.9	
Other miscellaneous nondurables	1.5	
Containers and packaging		
Glass containers		9.2
Beer, soft drink	4.7	
Wine, liquor	1.3	
Food and other	3.2	
Steel cans		4.1
Beer, soft drink	1.0	
Food	2.3	
Other nonfood cans	.6	
Barrels, drums, pails, misc.	.2	
Aluminum		0.6
Beer, soft drink	.4	
Other cans	.02	
Aluminum foil	.2	
Paper, paperboard		17.0
Corrugated	9.2	
Other paperboard	4.0	
Paper packaging	3.8	
Plastics		3.3
Plastic containers	.3	
Other packaging	1.6	
Wood packaging	1.3	
Other miscellaneous packaging	.1	
Total nonfood product waste		62.9
Add: Food waste	16.7	
Yard waste	19.2	
Miscellaneous inorganic waste	1.4	
Total		100

Source: Fourth Report to Congress: Resource Recovery and Waste Reduction, pp. 14, 17; Office of Soild Waste, Resource Recovery Division, and Franklin Assoc., Ltd.,
* revised January 1977. Details may not add due to rounding.

When establishing market arrangements, it is important for those developing the recycling program to determine which markets will provide the most useful, reliable services and/or pay the highest prices for the reclaimed materials. Some programs have made agreements with intermediaries which haul their recyclables away from the collection site but provide no reimbursement. Although no direct revenues are obtained from these collection efforts, they do reduce disposal fees for these communities and conserve landfill space at their disposal areas. Other communities have located buyers who will supply collection bins and pick up reclaimed materials from recycling centers. These kinds of services may preclude the need to purchase additional equipment from the program and keep start-up costs low. When services and equipment are provided by a buyer, however, the price paid for the reclaimed materials usually drops. Similarly, when the buyer purchases materials which require additional handling or sorting before use (i.e., a load of mixed glass and cans), a lower price is paid than if the materials were sorted by the community. Some suggested questions to consider when making a strategic comparison of buyers or intermediary haulers are listed below:

1. What resources are provided by the buyer?
   a. Are collection bins or other equipment provided?

   b. Will materials be hauled by the buyer or will the municipality deliver them? If the recycling program arranges delivery, how far must the materials be hauled?

2. What specific preparations of reclaimed materials are required by the buyer?
   a. For example, must caps and rings be removed from glass bottles? Can glass and cans be mixed in one bin?

   b. Under what conditions would materials be rejected by the buyer or hauler?

   c. What additional processing and preparation would increase the price of the material?

3. What are the arrangements for payment for the materials?
   a. What price will the buyer pay per ton of material?

b. Do prices increase after delivery of a specific minimum tonnage?

c. When will payment be made? Upon delivery? Weekly?

In conjunction with a market survey, the municipality must decide whether to sell its materials on the open market or to establish a contract. The open market approach allows flexibility, and is generally the most desirable. An important advantage is that if several materials dealers are competing for recyclables, the program sponsor can shop for the highest market price. A significant disadvantage is that severe financial losses may be experienced during periods of low market demand.

Unlike the open market approach, a contract guarantees that the recyclable materials will be purchased at a predetermined price under all market conditions. In addition, the contract usually guarantees that the buyer will receive a predetermined minimum tonnage of material at certain material specifications. Although the contract approach provides for stable market prices during periods of unstable market demand, some contract provisions may preclude taking advantage of high market prices.

B. Scope of the Multi-Material Recycling Program

Once it has been determined what materials and markets are available for source separation, the next step is to establish how the recycling program will be organized and administered. Specifically, what will be the scope of the program? The answer will depend on the following factors:

1. What type of community is involved — urban, suburban, or rural? Would neighboring communities be interested in participating in a program?

2. What is the current mode of solid waste disposal — landfill, incinerator, or other?

3. Is most of the solid waste collected at curbside or do a significant number of residents make their own drop-offs?

4. Based on the investigation of available markets and projected quantities, what materials should be recovered?

When instituting a recycling program, the temptation to start out on too grandiose a scale should be avoided. This does not mean that plans should not be made for increasing the types of materials to be collected once a recycling effort is established. A simple venture which is easy for the public to understand and participate in can lay the groundwork for a more comprehensive program in the future.

C. Collection System

Once contracts have been established with potential buyers, appropriate collection systems for each type of material can be examined — indeed, these may influence which buyer will be selected and/or what material(s) will be collected in the earliest stages of the multi-material recycling program.

If a new program merely diverts materials from one collection system to another little additional collection will occur and an existing collector may be harmed or even put out of business by the newly established program.

In fact, it is very likely that the recycling program may need to establish a variety of collection systems — voluntary curbside collection for some materials, centralized collection points for others, etc., to meet the needs of the buyers and secure the best market prices. While this may seem more cumbersome to organize, program developers should take advantage of every opportunity to meet the needs of the buyers, so as to create good working relationships with buyers. Collection systems which best meet the buyers' needs are also most likely to succeed in the long run, partly because the public (whose cooperation is essential) will become familiar with a consistent set of rules for collection.

Two common collection systems are:

Source separation and collection of recyclables starts in many cases when the recyclable materials are presorted by the individual and placed at curbside for collection (if this system is appropriate) or taken to a recycling center; are collected by volunteer organizations or by individuals earning an additonal income by collecting recyclables; by private haulers that collect recyclables; and by municipal collection systems that use city owned and operated collection vehicles or by the city contracting with private haulers for solid waste collection.

Separation after collection can be accomplished either by hand sorting after collection or by mechanical separation. This is usually done mechanically in a solid waste processing plant and frequently prior to waste being incinerated to recover its energy value. Most of these systems are capital intensive and run by private enterprise or city governments.

1. Multi-Material Recovery in Community Recycling Centers

Another approach to recycling is through multi-material community recycling centers. These differ from separated collection programs in that the participant is required to deliver waste materials to a central collection point. He either gives the material to those operating the center or is paid for the materials collected. During the late 1960's, as environmental awareness spread, thousands of collection centers for recyclables were set up in the United States.

Just as with other source separation approaches, however, there must be an awareness of the interplay between adequate markets, the high cost of transporting collected materials, the level of participation and the program's success. Start-up and operating costs are relatively low for recycling centers compared with those for high-technology resource recovery plants, and the quality of materials recovered can be high because they are hand sorted by residents. (Supervision may be needed to assure that components are not contaminated both when they are dropped off and during their processing.)

A community recycling center can be sponsored by industry, a municipality or by a private contractor. Many of the centers, particularly those in rural areas, recover material in the solid waste stream that would otherwise be lost. The closing of open dumps, as required by the Resource Conservation Recovery Act, may increase the value to a community of a recycling center because the amount of mixed waste headed for its landfill or incinerator is reduced.

2. Collection by Volunteer Organizations

For many years scouts, churches, civic organizations, schools, etc. have conducted collection programs for recyclable material. Today, many organizations have multi-material collection programs.

3. Individuals Collecting Recyclables

An increasing number of Americans are earnings an extra income by collecting and selling old newspapers, used corrugated boxes, magazines, aluminum cans, glass and plastic bottles.

These individuals establish a regular route and collect the materials for which there is an established market near their collection routes.

4. Private Haulers

Private waste haulers have collected recyclable materials predominantly from commercial and industrial establishments for as long as recycling has been ongoing in America. The materials collected are generated in large volumes.

5. Curbside Collection

In curbside separate collection programs, recyclable materials are conveniently collected at curbside, rather than having to be transported by householders, businesses or other generators of waste to a recycling center.

The factors a community must weigh in deciding the number of recyclable materials to collect include: anticipated participation, the comparable cost of centralized separation, the value of the materials, and the demand for recyclable materials. Trade-offs are involved in the decision. As the number of segments to be separated is increased, there is a drop off in participation and an increase in the complexity and thus cost of equipment. On the other hand, however, the cost of subsequent processing is reduced and the quality and value of the recycled materials improve.

An important consideration in curbside collection will be to design the system in such a way that recoverable materials do not become litter. In many CCS communities, and some others, ordinances specify how long before collection refuse may be placed at the curb. A similar ordinance might be appropriate for recoverable materials awaiting pickup. Program developers will also need to work with buyers to find out how recoverable materials should be containerized for collection.

D. Equipment

A major initial expense is likely to be the purchase of equipment. How large or small this amount is will depend on many things. For instance, will the buyer of the materials provide any equipment? Will he pick up the material or will trucks be needed? What type of modifications, if any, will have to be made on existing equipment? Is there a chance that equipment will be donated or will it have to be purchased? Potential costs for initiating a program can be great. Equipment purchases will usually be made through a municipal general fund or, if a private organization is involved, a bank loan and/or community donations. Although grants may be available through public or private agencies, the project should not be dependent on such an award. Strong financial commitment to the program, especially during the start up phase, is essential to its survival and growth.

E. Public Education Program

Citizen awareness and participation are essential for the success of an multi-material recycling program. Public relations and education which encourage citizen participation will show them the benefits of recycling, how to separate their materials and familiarize them with systems.

During the organizational phase of a source separation project, a portion of the budget should be allocated for an ongoing publicity/education campaign. The manner in which the campaign is handled will depend on existing public awareness and the size of the community involved.

CLEAN COMMUNITY SYSTEM cities and counties will have a fine groundwork for this public education effort. Each CCS program (see Appendix VI) already has sub-committees comprised of leaders from business and industry, the media, community organizations, local government and schools. These "gatekeepers" of a community's waste-handling habits, who were instrumental in bringing about substantial reductions in litter, can provide the same leadership in the recycling area. CCS cities may find it expedient to create a special "Recycling Sub-committee," including liaison representatives from each of the other sub-committees.

A low key personal approach, using door-to-door contacts, community newsletters and meetings, may be the most effective for a small community, while mass media outlets (such as television, radio, and newspapers) may produce better results in a large metropolitan area. Special groups within a community may need an approach tailored to them in the same way. In areas with a sizable Latin or Chicano population, Spanish might be used in the announcements. Whatever means of communications is chosen, efforts to teach the public how to use the system should begin at least three weeks in advance of the implementation of the recycling program. Promotional materials for curbside service should contain information about collection schedules — how often and on what days collections will occur. If a recycling center will be in operation, residents will need to know its location and the hours during which it is open. Citizens must also receive detailed information about what is acceptable and what is not acceptable in the preparation of recyclable items — for example, should materials be placed at the curb on rainy days or held for the next collection day? All communications should stress the program's benefits to the community and the people in it — including estimated savings to the city budget, savings in landfill space and revenue to individuals and/or civic organizations.

Experience has found that public participation tends to increase with the age of the program. However, public education should continue on a regular basis after program inception to remind householders about required material preparations and to inform new residents of the program's existence. Because of the usual constraints of personnel and budget, it may not be possible to continue to use cost-intensive types of publicity after program implementation. Some communities receive help from local environmental groups, civic and neighborhood organizations, garden clubs and scout troops.

Described below are the forms of media which have been used to stimulate community participation in recycling operations. Communities can use a combination of these approaches to reach a variety of interest groups.

Media Forms

Surveys indicate that a letter signed by community leaders and sent to each household can be very effective means to motivate participation. Such a letter is

often used at the beginning of a curbside program to introduce the public to the changes in the waste pick-up system.

Instructions are often sent along with other city mailings, such as water bills, to defray costs. Attractive flyers given to children at school, passed out at fairs or meetings, or distributed door-to-door, have also proven helpful.

Newspapers

Newspapers are an inexpensive publicity channel available for those communities with a local paper. Most newspapers have "Around the Town" or "What's Happening" sections or calendars that might list recycling program activities and dates. Prior to program start-up, municipality officials should personally visit reporters and editors to let them know what the program intends to do and how soon it will be under way. Once contacts have been made, press releases might be prepared by officials to: 1) invite reporters to attend and report a scheduled news conference or event, or 2) provide a longer statement containing information which the recycling organization wants to publicize. Local media deadlines should be learned so that press releases and news conferences may be scheduled to accommodate them. A press release should reach the reporter or news department three or four days before an event will occur to allow the reporter plenty of time to plan coverage.

Radio

Radio coverage can be a valuable and inexpensive source of publicity. Radio stations have talk shows, education programs, and community events calendars designed to allow public access to the airways for discussions on community events and issues and to inform the community of events of local interest. Broadcast stations also provide air time for public service announcements.

Radio advertising is an excellent way of reaching large numbers of people in the community relatively inexpensively. Organizations should contact local radio stations for information on how their recycling efforts can obtain air time.

Television

Television program and public service announcement requirements are more involved and expensive than those for radio and therefore more difficult to use — however, they also reach larger audiences for longer periods of time. Many stations will work with public interest groups to design quick and inexpensive public service announcements. These may be nothing more elaborate than a slide of the recycling program symbol with a brief audio message in the background.

Newsletters, Local Town Flyers, etc.

Community newsletters, church bulletins, employee newspapers, and other publications aimed at small and selected audiences can be useful for announcing new programs or providing handy reminders of ongoing activities. Brochures and pamphlets explaining all aspects of a recycling program can be printed up relatively inexpensively.

Wall posters are effective in announcing the opening of a program. They are also a visually inexpensive way to remind the community of what materials will be accepted and where the recycling centers will be located. Posters should be displayed in places where they will stay posted the longest (store windows, taverns, restaurants, etc.).

The "Welcome Wagon" or local real estate agencies should also be contacted to see if they will include information about recycling programs in the information packets which they provide. Still another way to publicize a program is to list recycling centers in the Yellow Pages under "Recycling."

School Programs

Schools may become involved with recycling programs in a number of ways. A visual presentation prepared by recycling organizations concerning the community's waste disposal habits can be a vital learning experience. A tour to the local dump or landfill followed by a tour of the town's recycling center can expand on this experience and further understanding of the benefits of recycling. KAB's "Waste In Place" program is a proven K-6 curriculum on solid waste handling (contact KAB for information).

Another way to involve school children in the program is to sponsor poster, essay and logo contests. Encouraging the involvement of school children will help establish positive attitudes toward recycling and may inspire more adult cooperation. Civic groups and schools may be a source of volunteers who would work in a door-to-door campaign distributing recycling information and answering questions.

IV. RECOVERY OF MATERIALS

In this section of the manual each recyclable material and its collection system will be described in detail. The important consideration when developing a multi-material recycling program is that each recyclable material is different. Collection systems may differ, markets or buyers are different and all variables may differ from one region of the country to another.

For instance, in rural areas, buyers of recyclable materials are widely scattered. Generally speaking, shipping distances are longer and costs are higher and demand for recyclables can be low, particularly during periods of reduced demand.

A. ALUMINUM RECYCLING

A. Aluminum Recycling

Introduction

While aluminum recycling is not new to the industry, recent years have shown tremendous growth of public involvement. Consider, for example, the growth in recycling of used aluminum beverage cans.

In 1972, the first year the aluminum industry kept statistics on recycling, 53 million pounds of aluminum (1.2 billion cans) were recycled, representing just about 15 percent of all aluminum cans shipped that year.

By 1981, more than a billion pounds of aluminum (24.8 billion cans) were recycled — more than half of the aluminum beverage cans shipped that year. Within the next few years, the aluminum industry is forecast to be recycling 75 percent of the beverage cans it manufactures.

Obviously, recyclers have learned the advantages of recycling aluminum. The scrap value of used aluminum beverage cans and other forms of recoverable aluminum offers recyclers a major economic incentive to recycle aluminum. Energy conservation is another important consideration, because recycling aluminum saves 95 percent of the energy required to make aluminum from bauxite.

Who Recycles Aluminum?

Aluminum recycling can be found in virtually every community these days. The scope of aluminum recycling, broader than the recycling of other basic materials, ranges from major aluminum producers to independent scrap dealers and from beverage company programs to recycling by supermarket chains. Hundreds of thousands of individual recyclers of all ages and an endless variety of groups also are involved actively in aluminum recycling.

If you plan to utilize existing aluminum recycling businesses as a market for your aluminum collection drives, the telephone yellow pages under "aluminum" and under "recycling" will supply the location of your nearest aluminum recycling center. Before you take aluminum to the center, you may want to check on any special requirements.

For instance, many centers require long pieces to be cut into three-foot lengths and bundled. This makes weighing and handling the metal easier. Also, be sure to ask about the price they are paying and if that price differs between cans and other miscellaneous scrap. Some buying locations also will offer a bonus or premium on large loads, in effect making quantity an attractive incentive. (If you are interested in a more detailed approach to establishing your own aluminum recycling center, that is covered after in this section.)

What Forms of Aluminum Are Recyclable?**

Anything that is made of aluminum is recyclable, and will generally be accepted at local recycling centers, although all-aluminum beverage cans are the most commonly recycled form of aluminum. Other aluminum items, such as siding, gutters, downspouts, storm door and window frames, lawn furniture frames and many, many other aluminum items are recyclable. Just be certain the aluminum is not contaminated by other materials, such as steel rivets.

Are All Beverage Cans Aluminum?

Not necessarily, some may be steel cans, even though they will have aluminum tops.

How Can You Tell Which Cans Are Aluminum?

The most reliable way is with a magnet. A magnet will stick to a steel can but not to an aluminum can. Aluminum cans are generally lighter than steel cans. Aluminum cans have no side seams and quite often will be labeled "All-aluminum can" on the side of the can.

It is important to place a magnet on the side of the can since almost all beverage cans have aluminum tops, while the sides of the cans can be either aluminum or steel. So, testing the side of the can with a magnet is the only sure way to determine that the can is all aluminum.

What Happens To Recycled Aluminum?

In most cases, recycled aluminum is made into sheet for aluminum beverage cans. However, recycled aluminum can be used in other aluminum products.

What Happens To Aluminum In Garbage?

Aluminum can be separated from municipal refuse by technology that exists today. Since aluminum is one of the most valuable components of municipal refuse, its reclamation can be a major financial plus in total resource recovery systems. Aluminum recovery from solid waste can be accomplished by separating and sizing devices such as trommel screens, air classifiers, magnetic separators (to remove steel from the aluminum) and the like. The result is an aluminum concentrate that can be purified to clean metal by either eddy current separators or dense media systems.

How Can We Establish Our Own Recycling Center?

Since aluminum recycling generally has proven to be an economically viable business, most people and organizations approach recycling as a business venture with the inherent risks and rewards.

When entering the business, there are several crucial factors which, if carefully considered, can be the difference between success and failure from an economic standpoint. If you are ready to approach the challenge of establishing an aluminum recycling business, be it on a small or large scale, these are some of the prime factors to be dealt with:

- **Market Conditions:** Ask these questions: Is there enough aluminum (particularly all-aluminum beverage cans) to justify setting up and staffing of an aluminum collection center or centers? (You might be better off just organizing collection drives and selling to an already-established local recycler.) How much of the local beverage market is in cans, and of those cans which brands are in aluminum? In most cases you will find practically all beer cans are all-aluminum and, depending on location, much of the soft drinks in cans are in all-aluminum also. The easiest way to determine this without a sophisticated market survey is to canvass a number of consumer outlets including supermarkets, convenience stores

and liquor stores to see exactly what is in aluminum and what is not. If you have the time and resources available, your time would be well spent to call on beverage distributors and retailers to find out exactly what their percentage of cans to bottles is and if they have any plans to alter that mix in the future. Another good source of information is the local representative of the USBA (United States Brewers Association). These people are usually filling a lobbyist's position, so key information on beverage distribution statistics generally is readily available from them.

- **Business Permits & Zoning Regulations:** Most municipalities of any size will have a planning and community development office, a portion of which will deal with nothing but permits for any type of business, and another portion with zoning restrictions and approvals. If the planning and community development office telephone number is not readily available, contact the city manager's or mayor's office or the local chamber of commerce. All of these agencies have people whose job it is to assist organizations and businesses in establishing such programs.

- **Collection Center Location:** Convenience to the public, storage capacity, loading space, utilities, ease of maintenance, appearance, all should be considered when selecting a site for your permanent center of operations.

  Your first concern should be for the recycler and making it convenient and as attractive as possible so that he will want to bring his aluminum to your location. Your storage capacity should be adequate to hold probably at least one week's collections, depending on the frequency of pickup by your own buying source.

- **Equipment:** Basically, this operation can be run with a minimum of equipment, but to provide a collection center which is at once efficient and productive, a few pieces of operating equipment are required, including: a scale with which to weigh a customer's payload; a magnetic separator to separate out any steel cans which might be mixed in with the aluminum cans; a flattener to densify the cans for ease of shipping; and a blower to facilitate movement of the cans from flattener to trailer.

  Two types of scales can be utilized, a hanging type or a platform type. The platform type is usually more expensive, but also has the feature of being able

to handle more weight than a handling scale. A platform scale with a 1,000-lb. capacity can be purchased for around $600, and a hanging scale for about $400. A magnetic separator can be obtained for about $3,000 and a flattener-blower for about $6,000. A blower to handle whole (or uncrushed) cans costs* about $3,000. A package containing a magnetic separator, flattener and blower system can be purchased for about $8,000-$10,000.

If you want to shred or bale cans, the investment will be significantly higher. A shred system with surge hopper, variable speed drive system, shredder and* shredder motor, blower and piping-ductwork system will start at $65,000. An auto-tie baling unit alone will cost a minimum of $80,000.

Personnel requirements obviously will be determined by your projected volumes. A good rule of thumb is that one person can purchase and process 50,000 pounds a month, based on a 40-hour week.

. **Competition:** This will be important to you when considering collection center location, pricing, and even making determination as to whether or not you even want to enter the market. If you are in a small market which is already saturated by scrap dealers, recycling companies, independent recyclers, and other groups and charitable organizations already involved in aluminum recycling activities, you might be wise to enter into a joint agreement with one of them, all the while utilizing your approach through the KAB and CCS programs to effectively utilize aluminum recycling in your overall efforts.

Aluminum recycling pays from both a monetary and educational standpoint. By participating in recycling, people earn money and become more conscious of ecology, while learning that as individuals we can do something important to improve our world. (Further information on aluminum recycling companies can be obtained from The Aluminum Association, 818 Connecticut Avenue, Washington, DC 20006.)

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*These prices are estimates based on information compiled in January, 1983, and depending on various suppliers are subject to change.

**The National Association of Recycling Industries, Inc. publishes a circular, "NARI Circular NF-82", that contains the nationally recognized specifications for nonferrous scrap metals.

B. RECYCLING PAPER

B. Recycling Paper

Introduction

Currently in the United States approximately 18 million tons of waste paper are collected for recycling. Of the 18 million tons collected, about 12 million tons are post consumer wastes and 6 million tons are industrial wastes in the form of clippings generated in plants making paper products. Over 26% of all the paper used in this country is now being collected and utilized as raw material to make recycled paper products in the U.S. or this waste paper is exported to countries overseas.

In 1972, approximately 12 million tons of waste paper was collected for recycling, therefore, in the last 10 years there has been a 50% increase in collection to meet the increasing demand. Of the 18 million tons recycled annually, the paper industry uses approximately 15.5 million tons. 300,000 tons are used to make other products such as insulation and building products and the remaining 2.2 million tons are exported to recycling mills overseas. The U.S. is the major exporter of waste paper in the world.

An important consideration before embarking on a paper recycling program is to make certain that there is a guaranteed market for the paper to be collected. Keep in mind that collection is only the first step in recycling. Recycling takes place when waste paper is used as a raw material to make a new product and during that process the waste paper loses its identity.

How To Locate Markets

There are approximately 1,600 waste paper dealers in the U.S. who buy paper from collectors. Waste paper dealers are listed in the yellow pages of the telephone directory under "waste paper" or, as is the case in some areas, under "recycling." Before embarking on any recycling program for waste paper, it is imporant to contact the dealers in your area. It would be best to visit with them personally. During this visit, you will learn what grades of recyclable paper they are buying, the prices that they are paying, the quality they require, and how the recyclable paper will be transported from its point of generation to the dealer who will buy the paper. Also, there are approximately 100 recycling paper mills that buy recyclable paper at the mill. Most of these mills are also identified in the yellow pages.

Most mills that buy recyclable paper at the mill site require it to be delivered to them in a form that can be handled easily. Usually it is delivered in pick-up trucks or vans and the driver must unload it onto a conveyor belt where it can be automatically handled in the manufacturing process.

GRADES OF PAPER CURRENTLY BEING RECYCLED*

Old Newspapers

Old newspapers generated in the home are the major grade of post-consumer waste paper where individuals get involved in the source separation and collection system. First, residents must pre-sort the old newspaper from other household wastes keeping it clean and uncontaminated. Usually it is string tied in bundles or inserted into kraft shopping bags. Old newspapers are also generated in hotels, motels, train and railroad stations and airports. Once old newspapers are co-mingled with other household wastes such as food waste, it becomes contaminated with odor and bacteria and is not economical to recycle in the paper industry mills that consume old newspapers as raw material.

Old Corrugated Containers (OCC)

Used corrugated boxes are generated in retail stores and factories when the merchandise is removed from the box. The box is flattened and kept separate from other waste and collected by a private hauler or an individual setting up his own business to make money in waste paper recycling. The important part here is that collection must be regular, and worked out at the convenience of the generator. Large supermarkets usually bale their OCC and sell it directly to recycling mills. Sometimes, the OCC is sold to a waste paper broker, who pays the supermarket for the OCC generated and the broker contracts with a hauler (sometimes he uses his own trucks) to deliver it to the recycling mill. Small retail stores and factories, depend upon individuals who collect OCC in their own vehicles. Usually they do not pay the generator for the waste, but merely provide a service and save him the cost of contracting with a private hauler to remove the used containers. Very few used corrugated boxes are available from homes because the normal home owner only receives a corrugated box with a mail order shipment, when taking home his groceries on an occasional basis or when buying products packed in corrugated boxes.

Mixed Office Waste

The waste paper generated in offices is collected by private haulers who have the option of sorting recyclable paper from the waste they collect or disposing of it at a landfill or an incinerator. Whether the hauler will sort this waste depends upon how much the dealer is willing to pay for mixed papers. Usually the price is low, but if it is more than the cost of a tipping fee (dumping charge) then the hauler will dispose of this rather than sell it. A new grade of waste paper is being generated in large offices and that is paper that is sorted at the desk of the workers in the office. Usually there is a separate rack on the desk top for white papers sorted from other office wastes. The white paper is removed by the worker and taken to a central point where usually there is a bin on rollers that is removed periodically and taken to the loading dock. There a hauler picks up the waste paper when there is a sufficient quantitity to justify a stop. In any newly established recycling program, there may be a real opportunity to encourage offices to sort recyclable paper and make it available to those organizing the recycling program. The office building can donate the paper to the recycling programs. If the program is non-profit, there may be a tax deduction for a contribution to charity. When the quality of the office sort program is established, there should be a strong market for this new grade of pre-sorted office waste.

High Grade Waste Paper

High grade waste paper is generated in the paper converting plants located throughout the U.S. The envelope, business form, book, catalogue, machine trimmings and clippings are usually of such high quality and value that the commercial printer who generates this high trade waste sells it directly to the recycling mill or to a waste paper broker.

This is an industrial waste and because it is already being recycled it would not lend itself to a recycling program.

How the Collection System Works

The collection system for recyclable paper works in many ways. For old newspapers, frequently it is collected by charitable groups such as scouts, 4-H, students and churches. The charitable organizations will announce a paper drive, and on a

Saturday morning go door-to-door to collect the old newspaper saved by residents. They will have a market for the paper established before the collection program starts. Frequently they bring this paper to a central point where the waste paper dealer or recycling mill will spot a truck into which the paper is loaded and when the truck is full the dealer or mill will pick it up for transportation to the mill. The charitable organization will be credited for the value of the paper as it was weighed in at the mill and the money will be automatically deposited in the charitable organization's bank account. In some instances, such as school and church programs, the waste paper dealer or recycling mills will place a large bin in the parking lot of the school or church. Students or church-goers will bring their papers in on a regular basis and when the bin is filled, it will be removed by the dealer or mill and transported to the recycling mill. In some instances, old newspapers are transported by residents to a recycling center. The recycling center merely takes the paper from the resident. The resident is really giving them paper, or donating it, and the income is earned by the organization operating the recycling center.

Increasingly in the U.S., people wanting to earn an extra income are going door-to-door to collect old newspapers from people that live in their neighborhood. The neighborhood collectors sell the waste paper directly to the dealer. Students and retired people are the main core of collectors who have put themselves in business to recycle waste paper. In some areas of the country old newspapers are being brought to shopping centers where the individual places the old newspapers in a truck or bin and they are given coupons which would be redeemable at the supermarket to be used against purchases at the market.

Old corrugated containers, mixed office waste and high grades, are most frequently collected by private haulers who are in the business of hauling waste. If the waste paper has a market they will sell it to a dealer or a recycling mill. The important part of the collection system for these grades is a dependable collector who removes waste from the store, factory, office building, train station, or wherever it is generated so that the waste is removed and no longer is of concern to the generator. The generator is most interested in having a clean workplace. Also, the fire hazard that can be created by a buildup of a large quantity of waste paper. If it is removed regularly, the fire hazard can be reduced.

In some recycling center operations, local merchants make a truck available which allows the center's volunteer workers to set up a collection program so that the paper generated is collected by the recycling organization and the money earned for the sale of this paper can be credited to the recycling operation in the town. There are some difficulties with such an arrangement because of the insurance on the vehicle and also the protection of the volunteers from injury. Safety is, of course, an important factor to consider.

Contaminates of Waste Paper

Waste paper that is recycled must be free from other wastes, particularly food wastes, which contaminate the paper with bacteria and cause odor. Other materials which must be removed to make the paper of a higher quality are: metal, glass, rubber, plastics, textiles, wood and other extraneous materials. These contaminates are not easily removed in the recycling process, therefore, they must be hand sorted from the paper. Waste paper dealers and recycling mills will want to establish quality standards with the recycling organization that is involved in the collection of waste paper from the point of generation or from the recycling center prior to its delivery to a recycling mill.

SUMMARY

There are several do's and don'ts when developing a waste paper recycling program. First, it must be understood that because waste paper recycling is so extensive, a new program may be competing with an existing program. This is why it is so important to become familiar with ongoing programs by talking to waste paper dealers and all other organizations interested in recycling. The Chamber of Commerce, Lions, Kiwanis, schools, churches and youth organizations that have established recycling programs should be contacted.

Waste paper dealers may discourage collection during a period of over-supply. When the economy in the U.S. is in a period of recession, the consumption of waste paper also declines, and in such a period, additional collection is unwarranted. However, on the upswing of the economy, additional collection is necessary and dealers encourage the establishment of new programs, such as a community sponsored program. To assure a market for paper collected, it is preferable to have a contract with a dealer with

a "floor" price (the current price of waste paper from the waste paper dealer), or at least a letter guaranteeing a market for the paper to be collected.

Who to Contact

In establishing a waste paper recycling program, if there are additional questions that are not answered in this section of the recycling guide, contact the American Paper Institute, Paper Recycling Committee, 260 Madison Avenue, New York, NY 10016. The telephone number of the Paper Recycling Committee is (212) 340-0654. Additional questions can also be answered by the Paper Stock Institute of America, 330 Madison Avenue, New York, NY 10017. The telephone number of the Paper Stock Institute is (212) 867-7330.

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*The National Association of Recycling Industries, Inc. publishes a circular, "Circular PS-83", that contains the nationally recognized specifications for post-consumer grades of wastepaper. The National Association of Recycling Industries, Inc.'s address is 330 Madison Avenue, New York, NY 10017. Their telephone number is (212) 867-7330.

C. RECYCLING GLASS

C. Recycling Glass Containers

Background

In 1981 approximately 1,604,000,000 pounds (3 billion containers) of glass containers were recycled in the United States. Used glass bottles and jars are collected and remelted with raw materials to make new glass containers.

Ten years ago approximately 452,000,000 pounds of used glass containers were collected for recycling. Thus, there has been a 355% increase in post-consumer glass collection and recycling during that period. These dramatic increases reflect the commitment of the glass container industry to promote recycling to protect the environment, conserve natural resources, reduce energy consumption in the glass manufacturing process and reduce litter. More than 100 glass container manufacturing plants produce new containers in part from recycled glass. While there are a variety of secondary uses for used glass containers, the highest value use on a wide scale is as a direct substitute for raw materials used in the production of new glass containers. Recycled glass is also used in the manufacture of fiberglass.

Although the primary components of glass — sand, soda ash and limestone — are in abundant domestic supply, cullet has long been an integral part of the glass manufacturing process because of its economic advantage over virgin raw materials. The use of cullet also provides energy benefits. Since cullet melts at a lower temperature than raw materials, its use allows manufacturers to reduce energy usage and particulate emissions to the atmosphere. The market for used glass containers (cullet) has historically been characterized by high demand and stable, increasing price.

How To Locate Markets

As with recycling of other materials, it is important to determine the market for glass containers before embarking on a recycling program. Glass recycling is rapidly expanding in the United States. Every glass container plant is a potential market. Plants can be contacted directly or the Glass Packaging Institute in Washington, D.C. can provide help. Local glass recycling dealers can be identified in the phone directory.

The glass industry is a strong supporter of "multi-material recycling." Recyclers who recycle more than one material gain certain advantages and economies of scale. Items collected in a multi-material recycling center include glass, aluminum cans, multi-material newspapers, steel and bimetal cans and plastic beverage bottles.

Cullet Quality

Like other recycled materials, glass recycling follows the steps of separation, collection, transportation, processing and use. Consumers generally separate glass into colors (green, amber and clear) and keep it separate from other household wastes. Consumers should remove caps and rinse the container with water. Some plants have special processing equipment to remove contaminants. However, contaminant removal at the consumer level is recommended.

Cullet Collection

There is a great variety in the sources of cullet and the collection practices possible. While most of the glass containers used are at the consumer household (in the United States) concentrated usage is found at bars, restaurants, and hospitals. Unless recycled, used glass containers are discarded as waste at this level.

Citizens who collect glass containers for recycling do so for varied reasons ... community pride, to earn money, for the environment or for charity. You may wish to limit your appeal to community pride or help for the environment or you may wish to establish a monetary goal for a specific group or community project. You may choose to pay donors for their clean, metal free, and color-sorted glass containers. If you elect to pay for incoming glass, it should be on the basis of weight (requiring a scale).

Collecting glass bottles for recycling involves good planning and coordination:

Frequency of Collection - it is advisable to conduct a one or two day collection to gain experience in all phases of organizing and planning before you commit to a continuing or permanent program. The size of your community and local interest in recycling are among factors to be considered.

Selecting a Site - Look for a location which is central, has adequate drive-in and parking facilities, and space for storage containers. A shopping center or school parking lot is adequate for one-time collections. Vacant buildings such as warehouses, small industrial plants, and large service stations provide needed shelter for continuing collections.

Local government officals (especially the public works or sanitation department manager), the Chamber of Commerce and commercial realtors can render invaluable assistance.

Communications are critical. You will need the support and active cooperation of many segments of the community. Most of all, you will need to inform everyone about your glass collection program.

All of your advertising, publicity and promotion should specify these three requirements for incoming glass containers to be recycled: glass containers must be 1) empty and clean, 2) free of metal, except where processing equipment is capable of separating metal, and 3) separated by color.

Public Officials - Before you put your plant into action, it will help to personally inform leading public officials to enlist their support. Call on city, township, or county officials, especially those who have the responsibility of collecting and disposing of your community's refuse. You should also check on the necessity of a license and permit to operate your center.

Community Organizations - Youth, church, environmental, and service groups are very important to the success of your collection. They can provide manpower and can mobilize the community by neighborhood and section. They include Boy and Girl Scouts; 4-H; F.F.A.; Chambers of Commerce; Jaycees; Kiwanis; Lions' Club; environmental groups; PTA; etc. If you involve these groups early in your planning you will greatly increase the effectiveness of your efforts.

General Public - As soon as community leaders and organizations have been notified, tell the public about your collection. Since it takes the average

family a few weeks to accumulate discarded containers (glass makes up only six percent of municipal solid waste), you should publicize the collection for weeks in advance.

The most efficient way to inform the public uniformly about your plan is through publicity and advertising in the mass communication media (radio, television, newspapers, outdoor signs). You will find that all media are anxious to help. Other methods include bulletins (school, church, neighborhood), posters, public address announcements at meetings and social functions, etc.

Publicity - Call or visit newspaper editors and news directors of radio and television stations to inform them about WHAT the program is all about, WHO is sponsoring it, WHO is cooperating with you, WHY the project is important to the community, HOW you plan to operate the collection (how many people, how often, etc.), and WHERE the collection will be made. Keep these editors and news directors informed about all aspects of your program before, during and after your collection.

Collection Site Signs - Make it easy for people to find your collection site by use of attractive signs and posters. Use large dominant signs with maximum visibility to attract people to your site and smaller signs to identify sections within the site. Secure permission when necessary.

Some curbside collection programs are successful in the United States. A curbside collection program utilizes a collection vehicle which travels throughout the community making pickups. Voluntary aggregation of recyclable materials by several households lowers the cost of curbside collection.

Collection of the used glass containers at bars, restaurants and hospitals is also possible. Often these organizations are happy to have recycled materials taken for a low price because their trash removal costs are lowered as volume of trash declines.

As glass recycling has expanded in recent years, a variety of unique and interesting collection methods have been developed. Perhaps the most successful is the multi-material theme center (See Appendix I). Theme centers are designed to make recycling

fun. They function as a collection point for both consumers and moderate volume recyclers. Theme centers may utilize a railroad theme, circus theme, riverboat theme or any other that is attractive and interesting to consumers. Glass recycling is generally a major source of revenue for these centers.

Cullet Contamination

During the course of the normal recycling process, glass may be contaminated with a variety of other materials. Processing equipment has been designed to eliminate most of these contaminants. Such processing equipment has also made it easier to recycle glass by allowing some of these contaminants to be present in glass collected by a recycler.

Glass processing equipment is designed to remove magnetic metals, aluminum caps and labels. Organic wastes remain with crushed cullet and are burned in the melting process. Ceramic materials are not easily removed during processing, therefore, caution must be taken in collection to avoid contamination with ceramic materials such as china, baking glass, headlight and window glass.

Glass container plants have quality standards which will be established with the recycling organization that is involved with used glass container collection. These standards may vary somewhat according to the ability of the plant to process cullet and remove contaminants.

Summary

Glass container recycling is increasing rapidly. Glass container plants have been able to provide a stable steady market with consistent and increasing prices. Glass recycling has proven to be an important revenue provider that is profitable for the new recycler or for the recycler who desires to add another material.

Who To Contact

In establishing a glass container recycling program, further information can be provided by the Glass Packaging Institute, 2000 L Street, N.W., Washington, DC 20036; telephone number: 202-872-1280.

D. RECYCLING PLASTICS

D. Recycling Plastics

Plastics are recyclable. They are being recycled today within the industry to recover processing scrap, recycled after its initial use into other products, and processed after its initial use to recover its energy content.

Although all plastics can theoretically be recycled, it is thermoplastic material which is most often considered for recycling. Thermoplastics, which comprise about 80 percent of all plastics, can be remelted and reformed through a process akin to melting ice cubes and refreezing the water. Thermosetting plastics, which make up the balance of plastics materials, cannot be reformed and, therefore, have less potential for recycling.

Another factor to be recognized in considering the recycling of plastic is the fact that different types of plastics cannot be recycled together any more than can aluminum and steel. It is not uncommon to find that different types of plastics are used to make the same basic products, like shampoo and mouthwash bottles, for example. Once made into one of these products, it is difficult to tell one kind of plastic from another. Therefore, plastic products made of a single kind of plastic that is easily identifiable by type offer the most practical recycling opportunities.

The first real opportunity for recycling substantial quantities of plastics from post consumer use came with the introduction of the plastic soft drink bottle in 1979. First of all, the bottle is easily identifiable. Secondly, it is made of a single type of plastic (except in the case of the two-piece container where the base cup is made from a seocnd plastic material which can be easily separated from the basic bottle).

Though limited to non-food applications, the potential uses of recovered PET (polyethylene terephthalate) plastics are numerous. PET scrap is successfully being employed in the manufacture of fiber fill for jackets, pillows and sleeping bags, as an interliner for upholstery, as a fiber in carpet construction and as scrub pads. Additional uses include the manufacture of industrial stapping, wall tile, flooring and tail light lenses. PET bottles also can be coverted into unsaturated polyester, a material used in making fiberglass tubs, showers, sinks and boat hulls.

While it is still a fledgling industry, a growing number of plastics processors are experimenting with methods by which they can collect and convert empty PET beverage bottles into new products. As the technology improves and the economics are favorable, the percentage of used bottles which emerge in the form of new product applications is expected to increase appreciably in the 1980's.

Through its recycling committee, the Plastic Beverage Container Division of The Society of the Plastics Industry, Inc., is developing purity levels for recycling PET bottles into other products, and is providing other information to businesses and communities interested in becoming actively involved in this relatively new aspect of plastic recycling.

Other examples of the plastics recycling involve plastic bags and garment bags of low density polyethylene, the recycling of polypropylene automotive battery cases, and the recycling of ABS telephone hand sets. In each case, the success of these recycling efforts is related to a continuing supply of recycled material and an application for the recovered material which provides satisfactory performance and economic incentives.

All plastic products can be recycled in another valuable way. Because they are made from petroleum and natural gas, plastics are being recycled in several communities into fuel and aid in incinerating municipal waste and in transforming municipal waste into energy to produce steam and electricity. Plastics range in BTU value from 12,000 to 20,000 per pound as compared to wood at 9,000 and raw municipal solid waste at 5,000 BTU's per pound.

DIRECTORY OF PET RECYCLING FIRMS

The following firms experiment with uses for recovered PET bottles, process scrap PET material, or use PET scrap to manufacture new materials. In addition, the Society of Plastics Industry, Inc., maintains information on PET recycling developments. Contact John C. Malloy, Plastic Beverage Container Division, The Society of the Plastics Industry, 355 Lexington Avenue, New York, New York 10017, 212/573-9400.

Beta Industries
P. O. Box 157
Collierville, TN 38017
901/853-2680

Building Components, Inc.
7100 Decelis Place
Van Nuys, CA 91406
213/782-4122

Cameron Corporation
404 Wall Street
Fountain Inn, SC 29044
803/862-2592

Celanese Plastics Co.
26 Main Street
Chatham, NJ 07928
201/635-2600

Coast Polymers
12830 East Imperial Highway
Santa Fe Springs, CA 90670
213/868-0421

Deer Polymer Corporation
17 Industrial Drive
Holden, MA 01520
612/829-6736

E. I. DuPont de Nemours & Co.
Materials Reclamation Systems
Wilmington, DE 19898
302/772-5265

Midland Processing Inc.
2 Quaker Road
pomona, NY 10970
914/354-0300

Minnesota Mining & Manufacturing
3-M Center
St. Paul, MN 55101
612/733-9510

MKS Company
1401 West Elk Avenue
Elizabethton, TN 37643
615/543-2321

PET Recycling
401 North 3rd
Salina, KS 67401
913/823-3082

Plastics Recyclers
P. O. Box 1009
Richmond, CA 94802
415/235-0295

Pure - Tech Industries
4 Marnet Road
Pinebrook, NJ 07058
210/227-1000

Ralco Industries
1112 Rive Street
Woonsocket, RI 02895
401/767-2700

Recycling Research Inc.
100 Woodland Avenue
Morton, PA 19070
215/544-2444

Smith & Hill systems
P. O. Box 782
Eugene, OR 97440
503/689-7509

St. Jude Polymers Corp.
39 North Main Street
Mahonoy City, PA 17948
717/773-0368

Wellman Inc.
P. O. Box 188
Johnsonville, SC 29555
803/386-2011

E. RECYCLING SCRAP IRON AND STEEL

E. Recycling Scrap Iron and Steel

Introduction

Broadly, there are two types of consuming industries for the ferrous metals recovered from post-consumer wastes: chemical processing and remelt applications. The chemical processing industries include tin recovery and copper precipitation; remelt industries include steel mills, ferro-alloy production and iron foundries. The steel remelt, iron foundry and detinning markets are national in scope. The ferro-alloy market is primarily located in the eastern part of the United States, while the copper precipitation market is prominent west of the Mississippi River, particularly in the Southwest. The iron foundry market is particularly noteworthy because there are over 5,000 such foundries located throughout the country.

Each process or market specification addresses three parameters: yield, metallurgy, and physical characteristics. "Yield" usually refers to the amount of iron (Fe) available and is usually expressed as a percentage. The "non-yield" fraction usually refers to the organics or other contaminants in the ferrous metal product. Market value is a function of yield in every case, since buyers are purchasing the iron (and tin for the tin recovery industry); any other materials present are process contaminants. In many cases, low yield material can assess multiple economic penalties upon both buyer and seller, as explained later.

The metallurgical specifications refer to the other metals which are plated, physically attached, or alloyed with the ferrous product. The most critical elements of concern are tin, lead, aluminum and copper. Each market has unique metallurgical specifications, although some ferrous scrap can meet more than one of these metallurgical specifications.

The selection of equipment components and operating procedures in the recovery system affects these properties and, consequently, the usefulness of the recovered product(s) to individual buyers. Each individual buyer has slightly different specifications. The different types of separation systems implemented affect these specifications. Consequently, an entity that is going to recover any ferrous metals should determine who the buyers are prior to ordering any system components.

In most cases, the recovered ferrous metal product must be shredded to obtain maximum value. The type of shredder used is critical, since the shredding process has a great influence on the size and shape of individual ferrous metal pieces as well as the bulk density of the ferrous metal product. The ferrous product buyer's specifications must be clearly understood before selecting a shredder.

Final processing of the scrap metal may not be necessary, but will depend on the requirements of the consuming industry. Since a scrap dealer, or secondary materials processor, may already have the necessary equipment to do the final processing prior to delivery to market, it could possibly buy a recovered ferrous product or process the product for a fee. A secondary materials broker can often assist in marketing a recovered ferrous product.

Each potential market is discussed in the sections which follow. Included is a description of the process and the applicable material specification.

The Steel Remelt Market

The utilization of steel scrap in the steel making industry is traditional; in fact, it has accounted for 50% of the raw material used to make new steel for the last 30 years. About half of the scrap used is generated by the steel mills themselves as "revert" or "home scrap"; the remainder, about 30 million tons a year, is purchased from outside sources. While the ratio varies, about half of the purchased scrap is generally conceded to be secondary or "post-consumer" scrap metal.

The use of post-consumer ferrous products as a scrap material is not new either. Large consumer waste products, such as discarded automobiles and large appliances, have traditionally been remelted. Until recently, however, only very small percentages of steel cans ("tin" cans and bi-metal cans) were used for each melt. When national interest increased in source separation and resource recovery, the steel industry conducted controlled melting tests to ascertain the most efficient levels for remelting scrap cans in their furnaces. The results have been gratifying.

At the present time, scrap ferrous metals are melted in electric furnaces, basic oxygen furnaces, open hearth funaces, and even blast furnaces. Electric furnaces can use a feed stock of all scrap ferrous metal.

Probably more external factors affect the market price of steel scrap than any other commodity. Some of these, difficult to control by the scrap processor, are: short delivery cycles, availability of railroad gondola cars, freight rates, supply of metallurgical coke, and many others too numerous to mention.

In addition, the steel companies are concerned with levels of oxidation, non-ferrous materials, and yield. Oxidation, in the form of exposure to the elements, results in a loss of base metal (iron), thereby reducing (yield) revenue. The presence of non-ferrous materials in the steel products, such as wood, paper, rags, and even non-ferrous metals, creates operating problems in the charging cycle and metallurgy, respectively. Proper care in the processing cycle will minimize this problem and maintain specifications standards. Yield, of course, is the amount of steel actually recovered during melt and is generally proportional to the amount of ferrous materials in the product. Steel companies may base their pricing for the product on the anticipated yield, and failure by the source separation and/or resource recovery facility owner to meet the prescribed percentage will reduce the income to the owner. Thus, if a 50 ton load of "ferrous" products is shipped by the owner to a steel furnace and yield is only 80%, the owner will be penalized the 20% by direct loss in revenue; and, in addition, he will have lost the freight on 10 tons of non-ferrous materials included in the shipment. The steel company will be penalized because of increased charge time, slagging problems, and (probably) increased air pollution problems.

It is incumbent upon the owner to consistently deliver the best possible ferrous products to the steel remelt buyer in order to be guaranteed a continuing market.

The physical characteristics refer to the bulk density and/or size and shape of each individual fragment of ferrous metal. These physical characteristics are controlled completely by the processing technique selected. Some production specifications require high (70 lbs/ft^3) bulk densities; others insist on a low density product.

Normally, density can be increased by shredding or baling and, although such operatings increase scrap processing costs, the resultant savings in transportation can often offset these costs.

When selling steel scrap, it should be remembered that buyer's prices assume material is delivered to the buyer and prices are usually quoted on a gross ton basis (2,240 pounds) rather than on a net ton (2,000 pounds) basis.

Steel Remelt Specifications

Metallurgy: The presence of tin, carbon and copper are the most critical elements of concern, since aluminum generally slags in processing. The other elements are alloyed, and the acceptable levels vary between processes, plants, quality of the scrap used, and type of steel product made. Generally, post-consumer ferrous metals scrap can be used to make most new carbon steel products. Although every type of steel-making furnace can accommodate the recovered ferrous (even cans without detinning), it is probably used in more electric furnaces than in other types.

As a result of the success experienced by Granite City Steel in utilizing ferrous metals derived from refuse in its blast furnace, many other steel companies are also considering this application. In this case, the refuse-derived steel, which is primarily used food and beverage cans, is used to replace iron ore in the blast furnace, producing pig iron which is further processed to make steel. The blast furnace application has a slightly broader tolerance for metallurgical impurities than does the steel-making process, and it represents a high capacity marketplace for all ferrous metals separated from the nation's solid wastes.

Physical Characteristics: High bulk density is mandatory. Many companies insist on bales or bundles, and maximum size varies with the individual plant. Some prefer a "nuggetized" or briquetted product. Generally speaking, a minimum bulk density of 70 lbs/ft^3 is required for remelt.

Comments

The steel industry represents a significant potential market for scrap ferrous metals which might be recovered. Most of the steel plants can consume reasonable

quantities of recovered ferrous metals which have not been detinned; however, additional quantities could be consumed if the ferrous metals were detinned prior to use by the steel mills.

The value of material to the purchasing agents for the steel melt shops varies greatly. Generally, scrap prices are highest during period with high steel production. As a point of reference, the February 26, 1979 issue of Iron Age lists the Number 2 dealer bundle prices to be $80-$82 in San Francisco, $84-$86 in Los Angeles, $65-$68 in Philadelphia and $67-$68 in Chicago. It should be noted that these prices (as in all Iron Age prices) represent dollars per gross ton (2,240 pounds) delivered to the consumer.

The quantities of all scrap metals that the steel industry could consume is gravely affected by the amount of steel actually being produced at each of the plants. Inasmuch as American steel production is usually curtailed during an economic recession, reduced quantities of this type of material are purchased by the steel mills and the scrap prices reduced accordingly. For example, the September 13, 1982 issue of Iron Age lists the Number 2 dealer bundle prices to be $13-$15 in San Francisco, $10-$12 in Los Angeles, $38-$41 in Philadelphia, and $41-$42 in Chicago. While the steel remelt industry remains a very real potential market, it is subject to the vagaries of the national economic scene, as are all secondary materials.

During periods of low steel industry demand with a resultant low steel industry offering price for ferrous scrap, processing expenses plus freight costs may exceed the delivered scrap value. Areas furthest from a scrap-consuming steel industry facility will be most affected due to higher transportation costs.

The Tin Recovery (Detin) Market

Detinning is an industrial processess for recovering tin from tin-plated steel cans rejected in the can manufacturing process, from tin-plated steel cans recovered by source separation and resource recovery from municipal solid wastes (before incineration), and tin-plated steel scrap. In the United States, this industry is the only domestic source of tin. There are about 7½ pounds of tin in each ton of scrap cans. Detinners, who claim that recovered tin is purer than metal produced from ore, generally indicate a willingness to buy all available clean nonincinerated steel can scrap. Basically, tin

recovery is an alkaline chemical process in which scrap is treated with a hot caustic soda in the presence of an oxidizing agent, such as sodium nitrate or nitrite, and the tin is dissolved as sodium stannate. The tin is then recovered from solution as sodium stannate crystals, as metal by electrolysis, or as a tin oxide.

The Tin Recovery (Detin) Specifications

Metallurgy: High tin content (0.15% by weight minimum) is desirable and aluminum from bimetal beverage cans can be accommodated only in certain plants. Thus, presence of heavy ferrous scrap metal which is usually not tin-plated and aluminum tend to degrade the value of ferrous metals for this buyer.

Physical Characteristics: Product must not be tightly baled or compressed, and have a maximum density of 25 pounds per cubic foot. Detinning depends on chemical reaction on the surface of the metal, so a high surface-to-volume ratio is desirable. An ideal product is uniformly-sized "coupons" of constant thickness material. Some detinning plants with large shredders can accommodate material which has been loosely baled for shipping economies, but this situation must be verified. Detinned ferrous scrap is a desirable product for the steel remelt industry and copper precipitation iron market.

Comments

The tin recovery industry should be regarded as a very real potential market for tin-plated ferrous metals which might be derived from post-consumer wastes. The tin recovery plants recover tin from various sources of tin-plated steel and supply detinned steel to the copper precipitation industry and Number 1 detinned bundles to the steel industry.

Inasmuch as the steel remelt industry could accommodate more detinned steel than tin-plated steel, it is apparent that the tin recovery industry augments other recycling industries.

The Iron Foundry Market

Iron foundries represent a large potential market for post-consumer ferrous metals recovered by source separation and resource recovery. The American Iron and Steel Institute and others have sponsored research programs directed towards the use of unincinerated municipal ferrous scrap metals recovered as charging material in gray iron foundries. Gray iron is a general term for lower grade cast iron used in applications such as pipe, grates and manhole covers. Metallurgically, it is distinguished by microscopic flakes of carbon dispersed throughout its structure. The AISI program recently demonstrated that a refuse derived ferrous product could be successfully used in gray iron foundries with cupolas; production tests were conducted by General Motors in Tonawanda, New York, and other foundries in Oakland, California, and Baltimore, Maryland. Similar tests have been made using incinerated scrap at Case Western Reserve University in Cleveland, Ohio, and elsewhere with very satisfactory results.

Foundries normally purchase only premium grades of scrap metals as raw materials for their production of cast iron. Since these grades of scrap (Number 1 Cupola Cast or Number 1 Heavy Melt) demand top prices in the scrap metal market, foundry operators could welcome a lower-priced scrap substitute when scrap prices are high, if their process metallurgy were not compromised. Every year these foundries produce on the order of 16-18 million tons of cast iron and steel. Of this, close to 65 percent, or about 11.3 million tons, is gray iron.

The Iron Foundry Specifications

Metallurgy: Metal contaminants normally found in source separated and resource recovery-obtained garbage steel can generally be accommodated by foundries making gray iron (rather than ductile iron) castings. These contaminants are primarily tin, aluminum and lead, and, depending on the product being cast, may limit the allowable quantity of recovered steel to about 10-20% of the foundry heat. Higher grade recyclable materials can be used to make gray, ductile and malleable cast iron.

The tin level is sufficiently low in most ferrous scrap and is generally not a problem in the production of pearlitic gray iron castings although tin must be severely limited in certain ductile and malleable iron products. Aluminum and lead also usually occur in acceptable concentrations in steel derived iron solid wastes.

Physical Characteristics: Product should generally be shredded and "balled" rather than baled. Although a dense product is desirable, most foundry cupolas cannot accommodate baled material. (However, some can accept one to two cubic feet bales). This factor should be evaluated with each prospective buyer of the material to verify specific requirements for baling or shredding, since final processing cost is a consideration.

Comment

The foundry market has the primary advantage of having thousands of foundries located throughout the country. In any relatively populated area, it is likely that at least one, and often more, gray, ductile or malleable cast iron foundry can be found. If this market can be exploited, transport costs by the recycling entity can be minimized in most instances. Those operators may be more successful in penetrating the foundry market by utilizing the services of a scrap metal dealer, although this situation may change in the future.

For reference, a listing of foundries with cupolas producing gray and ductile iron castings is published by subscription only by Foundry Marketing Services Department, Penton Plaza, Cleveland, Ohio 44114. Also a membership directory is published by the Gray and Ductile Iron Founder's Society, Inc.

The Ferro-Alloy Market

A fourth market for ferrous scrap steel is in the production of ferro-alloys, where iron is combined with carefully controlled amounts of other elements, such as silicon and manganese. These resultant materials are then used as additives in melts for alloy steel or casting in foundries, as well as other industrial applications. One principal ferro-alloy providing a market for ferrous scrap is ferro silicon, in which the iron source is ferrous scrap. Traditionally, either machine shop turnings or incinerator scrap have been used, depending upon the economic factors of supply and demand. However, for metallurgical reasons, incinerator scrap or unincinerated refuse derived steel normally should not exceed 50% of the input material.

For example, about 400,000 tons of ferro silicon are produced each year, creating an annual market demand of 200,000 tons of ferrous scrap. Therefore, the resultant national market potential for municipal ferrous scrap is about 100,000 tons annually. This represents a relatively small, but interesting, market. Other ferro-alloys provide similar market potentials.

The Ferro-Alloy Specification

Metallurgy: Since elemental iron is the crucial product, yield is very important. There are apparently no problems with normal quantities of copper, tin, aluminum, etc., found in refuse derived steel.

Physical Characteristics: Product generally must be shredded so that it can be used in existing material handling equipment. This requirement normally precludes baling. Density of such a product is approximately 27 lbs/ft ^{3}, so long distance rail shipping could be expensive.

Comments

The ferro-alloy market, although relatively small, represents an interesting alternative market in limited geographical areas for recovered steel.

The Copper Precipitation Iron Market

Thin ferrous sheet metal scrap, especially reclaimed cans, with all impurities removed, have a ready market in the copper industry as "precipitation iron." The process involves the use of these cans in a chemical reaction, which leaches out the copper from low-grade ores in the form of a copper cement. Basically, a 5-10% solution of sulfuric acid is percolated through a pile of copper-bearing ore. The resultant copper sulfate solution is collected and run into a concrete vat (launder) which typically is full of prepared steel cans. As iron sulfate forms, cement copper is precipitated in the launder. The solution is recirculated from the launder to the copper ore pile and back again to the launder. The chemical reactions continue (involving ferric, ferrous, cupric and cuprous sulfates) until the supply of iron in the launder has been exhausted,

being deposited in the ore pile as the insoluble iron sulfate. The cement copper deposited is washed, decanted, and sent to the smelter.

The process accounts for almost 15% of all United States copper production which would otherwise be economically unrecoverable. Approximately three tons of steel cans are used to produce one ton of copper; this represents a potential steel recycling market of eight billion cans a year or 500,000 tons of steel. Because the material must be of low density, transportation rates are comparatively high, and close proximity to a market is desirable.

Generally, the copper industry obtains precipitation iron from metal processors servicing only this market. These metal brokers purchase recovered steel cans and other light gauge steel from many sources and process this material by shredding, burning, detinning, and similar techniques to prepare it for use by the copper mines, which are generally located in western United States, Mexico and Canada.

Since the cementation process of copper recovery requires little energy and utilizes low grade ores or "tailings," the copper industry generally continues its relatively low-cost cementation process lines, even when other copper production has been curtailed because of limited demand and low prices. Thus, the copper precipitation market is a stable, reliable market for recovered ferrous metals; buyers of precipitation iron often execute five-year contracts with metal processors.

Copper Precipitation Iron Specification

Metallurgy: Product must be free of surface organics, coatings, lead, and aluminum although the presence of copper is acceptable. Ratio of oxides to ferrous metal is also critical; that is, "yield" should be as high as possible.

Physical Characteristics: Product must not be baled or tightly compressed and have a maximum density of 30 pounds per cubic foot. Precipitation process depends on chemical reaction on surface of metal, so high surface to volume ratio is desirable. Ideal product is uniformly sized "coupon" of constant thickness material.

Secondary Materials Industry

Scrap metal dealers and brokers represent a large potential market for all types of recovered metals. While this sector of industry is not a final consuming industry as are the other listings in this category, the scrap metal dealers, in a very real sense, provide products to all of the consuming industries listed, as well as supply them to all foreign buyers.

The importance of this industry to the potential source separation and/or resource recovery facility operator could be significant; scrap metal dealers can provide an extremely useful function as brokers for metal products which might be recovered. In this role, the dealer would provide a ready and continuing market for the recovered metals, process them as required, and resell to any of the ultimate buyers which offered the best current pricing structure. In other situations, the scrap metal dealer could provide additional processing such as shredding, nuggetizing, baling, detinning and burning, which might be necessary to meet the alternative buyer's specifications. In others, the scrap metal dealer could provide a real service in transporting the recovered ferrous metals (whether by truck, rail, or ship).

Some members of this industry have expressed a concern about local government entities using public funds to construct and operate source separation and/or resource recovery facilities which might duplicate some services and/or equipment presently available from the secondary materials industry. Should this occur, the local government could be obtaining post-consumer metal products and selling them at the consuming industry — in direct competition with the scrap metal dealers. This situation would, understandably, be regarded as unfair competition by these dealers.

On the other hand, historically the secondary materials industry, in general, has been unwilling to take an aggressive role in the recovery of resources from post-consumer solid wastes. Perhaps the ultimate solution to this question is some compromise in waste processing, whereby the local government would permit the secondary materials industry to perform the metals processing and refining steps to prepare the individual metal products for the final consumers.

Very likely, individual solutions will be tailored to each government-sponsored major source separation and resource recovery facility which will resolve these questions and others.

While some scrap metal dealers specialize in one or two types of metals, many deal in all types. A number of dealers should be contacted when assessing this industry's interest in recovered metals from a particular site.

Secondary Materials Industry Specifications

Over the course of the years, the secondary materials industry has developed specifications for the various grades of scrap metals which they process and sell. Generally, these specifications are descriptive paragraphs which satisfactorily define the type of scrap metal which is being addressed, rather than detailed metallurgical analyses. As might be expected, these standards have evolved over the years and still vary, to some extent, between individual dealers and consuming industries. Inasmuch as contaminated metal products mechanically derived from solid wastes have not been historically traded in quantity, the secondary materials industry, as well as other concerned industry representatives, participated in the ASTM activity to define standards for these products. Two standards were adopted for municipal ferrous scrap: ASTM E 701-80 and ASTM E 702-79. The specification document, ASTM E 701-80, defines the chemical and physical requirements for municipal ferrous scrap in the five market areas of copper precipitation, iron foundries, iron and steel production, detinning, and ferro-alloys. Requirements for chemical composition, metallic yield, cleanliness as measured by combustible content, and bulk density are included in ASTM E 702-79.

At this point, the specifications, published by the Institute of Scrap Iron and Steel, are the generally accepted standard for other grades of iron and steel scrap. Copies of these ASTM and ISIS specifications are included for reference.

There is no doubt that, if any source separation or resource recovery facility produced metal products which met any of these specifications, these products could be bought at a reasonable price by the secondary materials industry.

REFERENCES
Recycling Iron and Steel

American Foundrymen's Society
Golf & Wolf Roads
Des Plaines, IL 60016
(312) 824-0181

American Iron and Steel Institute
1000 16th Street, N.W.
Washington, DC 20036
(202) 452-7100

Can Manufacturers Institute, Inc.
1625 Massachusetts Avenue, N.W.
Washington, DC 20036
(202) 232-4677

Cast Metals Federation
20611 Center Ridge Road
Rocky River, OH 44116
(216) 333-9600

Cast Metals Federation consists of the following Societies:

Iron Castings Society
National Foundry Association
Steel Founder's Society of America
Non-Ferrous Founders Society

Ductile Iron Society
615 Sherwood Parkway
Mountainside, NJ 07092
(201) 232-3080

The Ferroalloys Association
1612 "K" Street, N.W.
Washington, DC 20006
(202) 659-4131

Institute of Scrap Iron and Steel, Inc.
1627 "K" Street, N.W.
Suite 700
Washington, DC 20006
(202) 452-7100

National Association of Recycling Industries, Inc.
330 Madison Avenue
New York, NY 10017
(212) 867-7330

Penton Directory
Foundry Marketing Services Department
Penton Plaza
Cleveland, OH 44114

F. COMPOSTING

F. Composting

Composting is a simple, cost-free way of recycling certain waste materials such as yard and kitchen trash. When the process is completed, the dark, crumbly compost can be spaded into the soil, enriching it as a growing medium. Composting is especially beneficial to city dwellers, who must usually buy top soil and fertilizer to improve the quality of their land. In addition to being clean, safe and thrifty, this method can also significantly reduce the volume of solid waste generated by householders.

With a little care and patience, any homeowner can create compost. In its simplest form, composting consists of making a pile of vegetable matter, including garden refuse such as twigs, leaves and cut grass and some kitchen garbage, such as fruit parings and coffee grounds and allowing it to decompose (this usually takes about three months, although results can sometimes be achieved in as little as six weeks). The rich, earthy, sweet-smelling product, added to planting pots or the garden, will bring valuable nutrients and humus to the soil.

Compost is formed through the action of certain microbes that proliferate when mixed organic refuse receives sufficient air and water. Bacteria, which generate a temperature of 150 degrees, literally cook the wastes. Besides constant air and water, essential ingredients to a compost pile are: using equal portions of soft and woody materials, cutting scraps to about one inch in diameter, building a pile between four and six feet tall, maintaining a moisture level of about 40-60% and selecting raw refuse that is on the alkaline side (high pH number).

Because of the heat created by the bacteria, composting can occur in nearly any kind of weather, except unusually severe conditions. Homeowners should select an out-of-the way spot on their property, where a bin can be placed. If yard space is unavailable, compost piles can even be put on level rooftop areas. In this case, several sheets of heavy plastic should be laid down first and six inches of soil spread over them. The following principles for yard compost bins will also apply to rooftop ones.

Composting is most efficent when the compost material is enclosed in a container. A box or bin should be built, which has air slits on the side and allows for free drainage and aeration at the bottom. The bin can be constructed out of almost any kind of material (wire fencing, cinder block, wood, masonry). The container may be divided

into three sections: one for incoming material, one for composting matter and one for the finished compost.

In order to aerate the compost and prevent it from becoming too wet, a shovel or pitchfork should be handy. A hose or watering can to moisten the pile is also necessary. A gunny sack, dampened and with weighted corners, should be placed on top to keep flies off.

Once vegetable wastes have been collected and cut into one inch pieces they can be placed in the storage portion of the bin until transferred to the "curing" bin. Each time a new layer of waste is added, it should be tamped down and moistened with water. Fresh wastes can be added daily or at longer intervals.

Turning the "curing" compost is necessary so that air reaches the center of the pile and peripheral material is shifted to the hot core where it can be broken down. Rotate the mass once every three days if it's not too soggy and every two days if it should become excessively wet.

Within several weeks, a portion of the "curing" pile will have become homogeneous and earthy and is ready to use.

V. Appendices

APPENDIX I
RECYCLING CENTERS

Appendix I

Recycling Centers

A recycling center is a location for collecting one or more recyclable materials. Recycling centers now in existence exhibit a variety of approaches for accomplishing recycling objectives.

A recycling center requires participating consumers to bring separated materials to a fixed collection point. At the center, the materials are received, stored and subsequently transported to a market. Some may also have the capability of sorting and processing. For example, metal cans would be sorted by type (steel, aluminum) and flattened. Glass would be crushed to provide better density after sorting by color.

Recycling centers normally are financially more successful when they collect more than one material. Multi-material recycling centers usually collect aluminum, newspapers, glass, steel and plastic. A few also collect other metals such as brass and copper, and other products which have been identified to have accessible markets such as corrugated ("cardboard") and motor oil. Anything that is recyclable may be included. Having many sources of revenue helps cover the normal operating costs of any recycling center.

Equipment requirements are directly related to the materials being recycled. It is advisable to contact companies which provide markets for advice when beginning a recycling center. Advice can be helpful in establishing good operating procedures as well as for determining the best equipment choices. Equipment for cans may include flatteners or shredders and a truck trailer. Usually, a trailer or storage bin is needed for newspapers. Glass needs a storage bin or box and one or more crushers depending upon volume. Plastic requires a storage bin or box and possibly a baler or shredder.

A recycling center may require other structural features depending on local conditions and the purpose of the center. For example, manned centers may require a building, heat and plumbing. Most centers require paved areas, fencing and lights. Centers which buy materials also require a cash register and a scale for weighing materials. Obviously, establishing a recycling center requires advanced planning and clear objectives.

Recycling centers vary in cost. This cost can be reduced by contacting those organizations who are interested in developing additional recycling. Many companies who are the markets for materials collected will help by providing or financing equipment. Land often will be available at little or no cost when used for the purpose of recycling. Check with the local city government. Having a non-profit status is helpful in getting donations.

Unlike curbside programs, recycling centers can handle a broader range of recyclable materials. The quality of materials is normally quite good, for many of the recycling centers have supervisors on hand. Private organizations and coalitions have been active in organizing these centers. Instead of having recyclable materials end up in the landfill or in the incinerator, the recycling centers provide a positive alternative for these marketable materials.

The best location for a center is in a light industrial area that is close to a populated section of the city. Most consumers that bring materials to a center are within a five mile radius. They are attracted by a location within easy reach of home. Advertising and publicity is very important for informing recyclers of the materials collected, hours of operation, and prices paid for materials. Theme centers (circus, riverboat, railroad) have been extremely successful because they make recycling fun for consumers. People who enjoy the experience are more likely to return. Accommodating the volume recycler who collects from other people, bars, restaurants, hotels and hospitals is also important to a successful center. Such recyclers need a facility capable of handling vans or small pickup trucks.

Recycling centers in the United States fill an important function efficiently and at low cost. With recycling rates still low in the United States for most materials, multi-material recycling centers are likely to be more prevalent in the upcoming years.

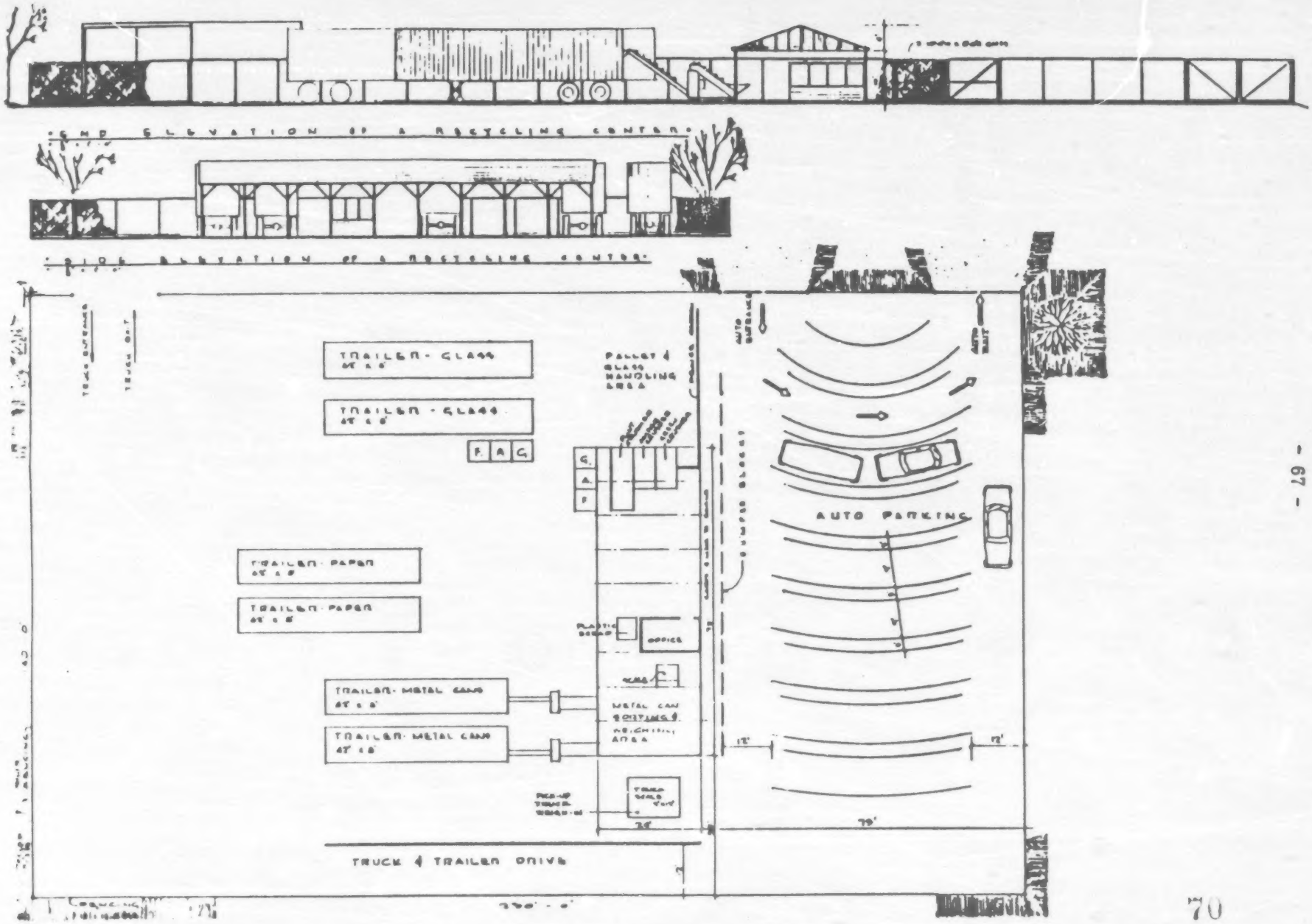
TRAILER - GLASS
TRAILER - GLASS
F A G
PALLET & GLASS HANDLING AREA
AUTO PARKING
TRAILER - PAPER
TRAILER - PAPER
OFFICE
TRAILER - METAL CANS
TRAILER - METAL CANS
METAL CAN SORTING & WEIGHING AREA
TRUCK & TRAILER DRIVE

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Figure 1 - Sample Ledger Sheet

PART A
Capital Costs (Recycling Program Only)

Buildings/Office Construction and Land Acquisition	$_____
Site Preparation/Improvement	_____
Construction of Retaining Walls/Bins/etc.	_____
Equipment	
Shredder	_____
Glass Crusher	_____
Compactor	_____
Front End Loader	_____
Trucks (pickup, hoist truck, etc.)	_____
Trailers/Satellite Trailers of Containers	_____
Roll-off Containers	_____
Miscellaneous Equipment	_____
Start-up Publicity and Education Costs (Signs, Advertisements, Notices, Pubications, etc.)	_____
TOTAL ANNUAL CAPITAL COSTS	$_____

PART B
Operational Costs (Recycling Program Only)

Labor Costs	$_____
Wages	_____
Fringe Benefits	_____
Overtime	_____
Part-time Personnel from Other Departments	_____
Vehicles	
Operation (gas, oil, etc.)	_____
Maintenance	_____
Stationary Equipment - Operation and Maintenance Including Replacement Cost	_____
Building Maintenance	_____
Utilities	_____
Insurance Costs	_____
Services from Other Departments (Consultants Accounting, etc.)	_____
Publicity and Education Programs	_____
TOTAL ANNUAL OPERATIONAL COSTS	$_____

PART C
Annual Revenue from Sale of Material

Material	Tons Recycled	Revenue Received
Paper	_____	_____
Glass	_____	_____
Aluminum	_____	_____
Other	_____	_____
ANNUAL TOTALS	_____ Tons	$_____

PART D
Calculation of Disposal Avoidance Credit (DAC)

Annual Cost of Operating Disposal Area/ Transfer Station/Incinerator (salaries, tipping fees, hauling fees, etc.) $_____

Annual Tonnage Disposed of _____ Tons

Annual Operating Cost_____ - Annual Tonnage_____ = Cost per Ton $_____

Tons of Materials Recycled_____ x cost per Ton _____ = DAC $_____
(from Part C)

PART E
SUMMARY

Annual Capital Costs (from Part A) _____

Annual Operational Costs (from Part B) _____

TOTAL ANNUAL COSTS $_____*

Annual Materials Revenue (from Part C) _____

Annual Disposal Avoidance Credit (DAC) _____

TOTAL ANNUAL REVENUES $_____*

*Total annual costs equal to or exceeding annual revenues indicates marginal program. A recheck of figures or program change may be in order.

Figure 1. Sample worksheet for calculating costs and revenues of typical recycling program. Not inclusion of "Disposal Avoidance Credit."

REQUIREMENTS FOR A MULTI-MATERIAL RECYCLING CENTER

Site Preparation - 25,000 sq. feet
Grading, 6" stone base, 3" asphalt
Fencing, 6' with (1) gate

Building - 1000 sq. feet, wooden construction
3 sided with 150 sq. ft. office; painted
4" concrete slab
Scale pit (small scale)
Misc. signs

Mechanical Systems
Infrared gas heaters (2) (LPG)
Floor scale
Truck scale (including installation)
Pit - truck scale

Electrical Systems
Inside lighting
Ouside lighting
120/240 volt power
460 volt power

Equipment
LPG 2,500 lb. forklift, standard mast
Can crushers (2) - 4,000 lbs./hour capacity
Aluminum & steel sorter
3 chain flail glass crushers
1 baler (newspaper, plastic, corrugated)
10 push carts
Portable scale
Wooden steps (paper trailer)
2 self-dumping hoppers
Bulk pallet containers and pallets

Office Equipment
Cash register
Furniture
Dictaphone

Trailers
Paper
Steel
Aluminum
Glass

APPENDIX II
GLOSSARY OF TERMS

Appendix II

Glossary of Terms

Aluminum: A silvery-white metallic element the most abundant in the earth's crust. It is used to form many hard, light, corrosion-resistant alloys.

Amber Glass: Term used by container industry for brown glass.

"Back-End" System: Jargon for any of several processes for recovering resources from the organic portion of the waste stream. (Front-end processes separate and recover the inorganic portion from the incoming refuse.) Back-end system operations include refuse-derived fuel recovery, conversion to oil or gas, fiber reclaim, composing, conversion to animal feed, etc.

Baler: A machine in which waste materials are compacted to reduce volume, usually into rectangular bundles.

Benefication Systems: The mechanical process of removing contaminates and crushing the glass to specified size. Also referred to as cullet processing equipment.

Biodegradable Materials: Waste material which is capable of being broken down by bacteria into basic elements. Most organic wastes such as paper and food remains are biodegradable.

BIRP: Beverage Industry Recycling Program.

Bottle Banks: Roll-off containers used for the collection, storage and transporting of used glass from the consumer. Sometimes these mobile bins are divided into three compartments for flint, amber and green glass.

Boxboard: Paper used in manufacturing of cartons and rigid boxes.

Broke: Paper that has been discarded anywhere in the manufacturing process. It is usually returned to a repulping unit for reprocessing.

Bulk-Cullet Boxes or Bulk Pallet Containers: Reusable corrugated containers, (e.g. 40 x 48 x 37 inches) used for storing and transporting cullet. Sometimes referred to as Gaylord boxes.

Buy-Back Programs: Programs to purchase recyclable materials from the public.

Chain-Flail Crushers: Inexpensive, low volume crusher which uses a chain to break glass containers.

Classification: To arrange or sort waste materials into uniform categories or classes, usually by size, weight, color, organic/inorganic, etc.

Collection: The act of picking up waste materials at homes, businesses or industrial sites, and hauling it to a facility for further processing, transfer to larger vehicles or disposal.

Collection Center: A facility designed to accept materials from individuals, usually for recycling.

Color Sorting of Glass: A technique for sorting by color glass reclaimed from solid waste. Two experimental methods have been developed: (1) Optical sorting which compares light reflected from each piece with light reflected from a background standard. Successive passes, with different light source filters and standards, could be color selective. (2) Magnetic sorting which utilizes high-intensity magnetic forces on small glass pieces to sort the clear glass from the colored glass (which contains iron compounds).

Combustibles: Various materials in the waste stream which are burnable, such as paper, plastic, lawn clippings, leaves and other light, organic materials.

Commercial Waste: Waste material which originates in wholesale, retail or service establishments such as office buildings, stores, hotels, universities and warehouses.

Compactor: Any power-driven mechanical equipment designed to compress and reduce the volume of waste materials.

Compactor Truck: A large truck with an enclosed body having special power-driven equipment for loading and compressing waste materials.

Composting: A solid waste management technique which utilizes natural processes to convert most organic materials to humus by micro-organism activity. Composting is not effective on plastic and rubber.

Contaminant: Foreign material that makes a primary material impure.

Corrugated Paper: Heavy paperboard, molded into parallel ridges and grooves (called linerboard and medium).

Cullet: (1) Waste or broken glass, usually suitable as an addition to raw batch.
(2) Foreign cullet - cullet from an outside source.
(3) Domestic cullet (factory cullet) cullet from within the plant.
(4) Mixed cullet-scrap glass which is not separated by color.

Deinking: A process in which most of the ink, filler and other extraneous materials is removed from printed waste paper or broke. This produces pulp which can be used along with varying percentages of virgin paper in the manufacture of new paper, including high quality printing, writing and office papers as well as tissue and toweling.

Dump: An open land site where waste materials are burned, left to decompose, rust or simply remain. Because of the problems which dumps create such as air and water pollution, unsanitary conditions and general unsightliness, dumps have been declared illegal in many states.

Ecology: The science of the relationship between organisms and their environment.

Effluent: Solid, liquid or gas wastes which enter the environment as a by-product of chemical or biological process, usually from man-oriented processes.

Energy Recovery: A form of resource recovery in which the organic fraction of waste is converted to some form of usable energy. Recovery may be achieved through the combustion of processed or raw refuse to produce steam (e.g. as a supplemental fuel in electric utility power plant boilers or as the primary fuel in incinerators), through the pyrolysis of refuse to produce oil or gas, and through the anaerobic digestion of organic wastes to produce methane gas.

Environment: The air, the water and the earth, sometimes called the biosphere.

Environmental Protection Agency (EPA): An agency of the Federal government responsible for the establishment and enforcement of environment protection standards.

Ferrous: Metals which are predominantly composed of iron. Most common ferrous metals are magnetic. In the waste materials stream, these usually include steel or "tin" cans, automobiles, old refrigerators, stoves, etc.

Flint Glass: Term used by container industry for colorless glass.

Flow Control: A practice by which state or local officals seek to guarantee the flow of all waste to the waste-to-energy plant. This practice stems from officials' need to assure an adequate supply of waste to keep the waste-to-energy facility (see Resource Recovery Facility) operating efficiently. A flow control ordinance can prohibit or even obstruct the free market access to recyclable materials which can be utilized as raw materials for the manufacture of new products.

Fly Ash: Small solid particles of ash and soot generated when burning coal, oil or waste materials. With proper equipment, fly ash is collected to prevent it from entering the atmosphere. Fly ash can be used in building materials, such as bricks, or disposed of in a landfill.

Fossil Fuels: Fuels, such as coal, oil and natural gas, which are the remains of ancient plant and animal life.

Front-End Loader: A refuse truck which has power driven loading equipment at the front of the vehicle.

"Front-End" System: Jargon referring to processing of municipal solid waste for recovery of materials (e.g., metals, glass and paper). A front-end system also prepares the organic portion in a form readily usable in energy recovery, or back-end systems.

Garbage: Waste materials which are likely to decompose or putrefy. Usually contains food waste from a kitchen, restaurant, slaughter house or food processing plant.

Glasphalt: A trade name for a highway paving material in which recovered ground glass replaces some of the gravel normally used in asphalt.

Glass: Vitreous material from the fusion of sand and soda ash, with adjuvant ingredients, common glass is impermeable, transparent, sanitary and odorless. Clear bottle glass is made basically by melting almost pure silica sand in furnaces at 2700°F, with burnt lime or limestone and soda ash. Crushed glass (cullet) has traditionally been added to make the mixture of raw materials more workable. Colored glass is usally obtained by adding small amounts of selected metals, salts or oxides such as iron salts or chromia.

Hammermill: A type of crusher used to break up waste materials into smaller pieces or particles, which operates by using rotating and flailing heavy hammers.

Hazardous Waste: Waste materials may cause or significantly contribute to serious illness or death, or that pose a substantial threat to human health or the environment when improperly managed. These materials include old explosives, radioactive materials, some chemical and some biological wastes, usually produced in industrial operations or in institutions. Not meant to imply that other wastes are non-hazardous.

High Grade Deinking: A paper industry term that refers to recyclable paper that is of a high and printed grade and that has been deinked.

High Grade Waste: Waste Paper that is of the most value in the market place. High grade waste paper includes trimmings and cuttings from converting plants, computer printouts, tabulating cards and desk top paper. High grade waste paper is often collected in offices. In the paper industry, high grade waste paper is referred to as pulp substitutes and high grade deinking.

Home Scrap: Scrap that is utilized within the plant where it originates.

Hydrapulper: a trade name for a large mechanical device used primarily in the paper industry to pulp waste paper or wood chips and separate foreign matter. The effect of pulping is to suspend finely divided cellulose fibers in water. This process has been incorporated in certain resource recovery systems.

IGP: Intermediate Glass Processors. Businesses or organizations who purchase cullet from smaller suppliers, process the glass, and sell the contaminant-free cullet to glass plants.

Incinerator: A plant designed to reduce waste volume by combustion. Incinerators consist of refuse handling and storage facilities, furnaces, subsidence chambers, residue handling and removal facilites, chimneys and other air pollution control equipment.

Industrial Scrap: Waste which is generated during a manufacturing operation.

Industrial Waste: Those waste materials generally discarded from industrial operations or derived from manufacturing processes.

Inorganic Refuse: Waste material made from substances composed of matter other than plant, animal, or certain chemical compounds of carbon.

In-Plant Waste: Waste generated in manufacturing processes. Such might be recovered through internal recycling or through a salvage dealer.

Intermediate Processor: A company that purchases source-separated materials from municipalities and private sanitation companies, processes the materials, and sells them to an industrial market, where the materials are used as a feedstock in manufacturing.

Junk: Waste materials such as rags, paper, metals, broken furniture, toys, equipment, etc. The term usually implies that the materials can be recovered or converted for reuse.

Kraft Paper: A comparatively coarse paper particularly noted for its strength and made primarily from wood pulp produced by the sulfate pulping process.

Leachate: A liquid containing decomposed waste, bacteria and other noxious and potentially harmful materials which drains from landfills and must be collected and treated so as not to contaminate water supplies.

Litter: Man-made (or man-used) misplaced solid waste. Solid waste discarded outside the established collection-disposal system. (Solid waste properly placed in containers is often referred to as trash and garbage; uncontainerized, it is referred to as litter.) Litter accounts for about two percent of municipal solid waste.

Magnetic Separator: Equipment usually consisting of a belt, drum or pully with a magnet used to attract and remove magnetic materials from other materials.

Methane: An odorless, colorless, flammable gas which can be formed by the anaerobic decomposition of organic waste matter or by chemical synthesis. It is the principal constituent of natural gas.

Mixed Office Papers: Mixed waste paper which is generated in the office and is of a high recycling value. This waste paper is of various kinds and quality of high grade waste paper. (See High Grade Waste Paper.)

Mixed Paper: Waste paper of various kinds and quality, usually collected from stores, offices and schools.

Municipal Solid Wastes: The combined residential and commercial waste materials generated in a given municipal area. The collection and disposal of these wastes are usually the responsibility of local government.

Newsprint: The kind or type of paper generally used for printing newspapers.

Nonferrous: Metals which contain no iron. In waste materials these are usually aluminum, copper wire, brass, bronze, etc.

Obsolete Scrap: Scrap material derived from products which have completed their useful economic life.

Old Corrugated Containers: Used corrugated boxes are containers that are generated in retail stores and factories when the merchandise is removed from the box. Old Corrguated Containers (O.C.C.) are a very important grade of the recyclable paper.

Old Newspapers: Used newspapers that are generated in the home. This waste paper is the major grade of post-consumer waste paper where individuals get involved in the source separation and collection system.

Open Burning: The burning of waste materials in the open or in a dump. Open burning produces smoke, odor and other objectionable air pollutants.

Organic Refuse: Waste material made from substances composed of chemical compounds of carbon and generally manufactured in the life processes of plants and animals. These materials include paper, wood, food wastes, plastic and yard wastes.

Packaging Materials: Any of a variety of papers, cardboards, metals, wood, paperboard and plastics used in the manufacture of containers for food, household and industrial products.

Paper: In a general sense, the name for all kinds of matted or felted sheets of fiber formed on a fine screen from a water suspension. More specifically, paper is one of two broad subdivisions (the other being paperboard) of the general term paper. Paper usually lighter in basis weight, thinner and more flexible than paperboard, is used largely for printing, writing, wrapping and sanitary purposes.

Paperboard: Relatively heavier in basis weight, thicker and more rigid than paper. There are three broad classes of paperboard: (1) container board, (2) boxboard and (3) special types such as automobile board, building board, tube board, etc.

Paperstock: A general term used to designate waste papers which have been sorted or segregated at the source into various recognized grades. It is a principal ingredient in the manufacture of certain types of paperboard.

Plastics: Man-made materials consisting of large molecules called "polymers" containing primarily carbon and hydrogen with lesser amounts of oxygen or nitrogen, frequently compounded with various organic and inorganic compounds as stabilizers, colorants, fillers and other ingredients.

Post-Consumer Cullet: Scrap container glass recovered after use by the consumer as opposed to in-plant or domestic cullet.

Primary Materials: Virgin or new materials used for manufacturing basic products. Examples include wood pulp, iron ore, silica sand and bauxite.

Pulp: Fiber material that is produced by chemical or mechanical means from fibrous cellulose raw material and from which paper and paperboard and made.

Pulp Substitutes: A paper industry term that refers to a grade of recyclable paper that is print free. (See High Grade Paper and Mixed Office Papers.)

Putrescrible: Subject to decomposition or decay. Usually used in reference to food wastes and other organic wastes.

Reclamation: The restoration to usefulness or productivity of materials found in the waste stream. These reclaimed materials may be used for purposes which are different from their original use.

Recycling: A resource recovery method involving the collection and treatment of a waste product for use as raw material in the manufacture of the same or a similar product, e.g. ground glass used in the manufacture of new glass.

Refuse-Derived Fuel (RDF): A solid fuel obtained from municipal solid waste as a result of a mechanical process, or sequence of operations, which improves the physical, mechanical or combustion characteristics compared to the original unsegregated feed product or unprocessed solid waste.

Residential Waste: Waste materials generated in houses and apartments. The materials include paper, cardboard, beverage and food cans, plastics, food wastes, glass containers, old clothes, garden wastes, etc.

Residue: The materials remaining after completion of a chemical or physical process, such as burning, evaporation, distillation or filtration.

Resource Conservation: The reduction of the amounts of solid waste that is generated, reduction of overall resources consumed, and utilization of recovered resources.

Resource Conservation and Recovery Act of 1976: This law amends the Solid Waste Disposal Act of 1965 and expands on the Resource Recovery Act of 1970 to provide a program to regulate hazardous waste, to eliminate open dumping, to promote solid waste management programs through financial and technical assistance and to further solid waste management options in rural communities through government grants.

Resource Recovery: A term describing the extraction and utilization of materials and values from the waste stream either as materials which can be used as "raw materials" in the manufacture of new products, or as values which can be converted into some form of fuel or energy source.

Resource Recovery Facility: Facilities that convert materials and values from the waste stream into some form of fuel or energy source. Also referred to as waste-to-energy plants.

Reuse: The use of a waste material or product more than once.

Roll-Off Container: Used primarily by the solid waste industry, the containers come in various sizes, are moved via a special truck, and can be placed and left on the ground.

Rubbish: A general term for solid waste that does not contain food waste.

Salvage: The extraction of materials from the waste stream for reuse.

Sanitary Landfill: A method of disposing of refuse on land without creating nuisances or hazards to public health or safety. Careful preparation of the fill area and control of water drainage are required to assure proper landfilling. To confine the refuse to the smallest practical area and reduce it to the smallest practical volume, heavy tractor-like equipment is used to spread, compact, and usually cover the waste daily with at least six inches of compacted dirt. After the area has been completely filled and covered with a final two- to three-foot layer of dirt, and has been allowed to settle an appropriate period of time, the reclaimed land may be turned into a recreational area as a park or golf course. Under certain highly controlled conditions the land may be used as a plot on which some types of buildings can be constructed.

Scrap: Waste material which is usually segregated and suitable for recovery or reclamation, often after mechanical processing.

Secondary Materials: All types of materials handled by dealers and brokers that have fulfilled their useful function and usually cannot be used further in their present form or at their present location, and materials that occur as waste from the manufacturing or conversion of products.

Separation: To divide waste into groups of similar materials, such as paper products, glass, food wastes and metals. Also used to describe the further sorting of materials into more specific categories such as clear glass and dark glass. Separation may be done manually or with specialized equipment.

Shredder: A mechanical device used to break up waste materials into smaller pieces by tearing and impact action.

Side-Loader: A refuse truck in which solid waste is loaded into the side of the vehicle.

Sludge: Waste materials in the form of a concentrated suspension of waste solids in water. One type of sludge is produced from the treatment of sewage.

Solid Waste: Discarded solid materials. Includes agricultural waste (e.g. animal manure, crop residues), mining waste (e.g. mine tailings), industrial waste (e.g. manufacturing residues), and municipal waste. (See Industrial Waste, Municipal Solid Waste, Residential Waste, Waste Materials.)

Solid Waste Management: Conduct and regulation of the entire process of generation, storage, collection, transportation, processing, recovery and disposal of refuse.

Source Separation: The segregation and collection of individual recyclable components before they become mixed into the solid waste stream (e.g. bottles, cans, newspapers, corrugated containers or office papers.)

Steel: Any of various hard, strong, durable, malleable alloys of iron and carbon, usually containing between 0.2 and 1.7 percent carbon, often with other constituents such as maganese, nickel, copper, tungsten, cobalt, or silicon, and widely used as a structural material.

Tin: A silvery metallic element obtained chiefly from cassiterite, used mostly to coat other metals to prevent corrosion and form parts of numerous alloys.

Tin Can: Essentially a steel can with a tin (approximately .0015 inch) coating. This tin represents one-third of the recycled value of the can while comprising only .25 to .4 percent by weight.

Tin-Free Steel (TFS) Cans: Cans made from low-carbon steel with a very thin anti-corrosion coating of chromium oxide rather than tin.

Transfer Station: A place of facility where waste materials are taken from smaller collection vehicles and placed in larger transporation trucks or barges for movement to disposal areas, usually landfills.

Trash: Waste materials which usually do not include garbage but may include other organic materials, such as paint trimmings.

Used Motor Oil: Any oil previously used in any machinery. Its main markets are in road oiling, industrial fuel and rerefining.

Virgin Materials: Any basic materials for industrial processes which has not previously been used, e.g. trees, iron ore, silica sand, crude oil, bauxite. (See Secondary Materials, Primary Materials.)

Volume Reduction: The processing of waste materials so as to decrease the amount of space the materials occupy, usually by either: 1) mechanical (crushing or shredding); 2) thermal (incineration or pyrolysis); or 3) biological (composting) processing.

Voluntary Separation: The separation of glass bottles, food and beverage cans or newspaper by hand by individuals or groups of individuals, at home or in local collection centers.

Waste Materials (Solids): A wide variety of solid materials that may even include liquids in containers, which are discarded or rejected as being spent, useless, worthless, or in excess. Does not usually include waste solids found in sewage systems, water resources or those emitted from smoke stacks.

Waste Paper: Paper that has been discarded. This paper can be used again as a recyclable material, if the grade of paper is acceptable and if the paper is separated before it enters the waste stream. Once recyclable paper enters the waste stream, there can arise legal problems with municipalities in retrieving the discarded paper. (See Flow Control.)

Waste Pulper: A pulping system designed specifically for waste material processing.

Waste Stream: A general term used to denote the waste material output of an area, location or facility.

Yard Wastes: Grass clippings, pruning and other discarded material from yards and gardens.

APPENDIX III
RECYCLING EQUIPMENT

Appendix III

Recycling Equipment

Officials who are starting a source separation program need to select equipment to collect and store recyclables. In selecting equipment, efficiency, cost, safety, labor requirements and the frequency with whch materials are collected should be considered. Brief descriptions of collection equipment (collection vehicles/hauling vehicles and storage containers) which are commonly used in either curbside service or recycling center operations are provided below.

To operate efficiently, collection equipment should have a capacity appropriate to the expected volume of materials. Volumes can be estimated by dividing the estimated weights of recyclables that will be collected by the density of a given material.

Compactor Trucks

Many communities use compactor trucks to collect recyclables, most frequently newspapers, because they are available as spare refuse collection equipment. Compactor trucks have larger capacities than special collection equipment such as racks and trailers and load and unload easily. When racks or trailers are attached, the combination can be used to collect both refuse and recyclables. One problem associated with using refuse compactors, however, is that contamination may occur if they are not cleaned before collecting recyclables.

Most municipalities use rear loading compactor vehicles operated by two or three member crews to collect refuse and recyclables.

Other Vehicles

Recyclables can be collected, without being compacted, by other spare equipment such as refuse scooters, or box-bed, pick-up, dump-body, and stake-body trucks. These smaller vehicles may be operated and maintained at lower costs than compacting vehicles and can be tailored to meet the needs of the program. In particular, they may be equipped with bins or drums to collect and store more than one material. Racks and

trailers may also be attached to noncompacting vehicles, many of which can be designed to handle heavy materials.

The major disadvantage of using noncompacting vehicles is that many do not have dumping mechanisms; materials must be unloaded manually. Furthermore, although the capacity of dump trucks, pick-up trucks and refuse scooters is greater than that of racks or trailers, these vehicles have lower capacities than compactor vehicles.

Compartmentalized Vehicles

Some municipalities use trucks which have distinct loading and storage compartments to collect two or more recyclables at once. Compartmentalized vehicles have a greater capacity than multi-material trailers or adapted trucks with bins. They encourage participation because they collect all recyclables on the same day and are very visible to residents. Although most compartmentalized vehicles are more costly than other types of equipment, they collect larger volumes of recyclables. Revenues from selling the recyclables, as well as savings to the refuse collector, may offset the higher costs of purchasing compartmentalized vehicles.

Dump trucks modified to include compartments, rear loading vehicles with a hydraulically operated bucket and flatbed trucks with bins are all compartmentalized vehicles in use in various communities. The capital cost of a flatbed truck with bins is less than that of most compartmentalized vehicles but its storage capacity can be slightly smaller. The bins can be unloaded easily and quickly with a forklift. The compartments in the truck body and loading bucket of rear loading vehicles are adjustable. The adjustable compartments compensate for weekly fluctuations in the composition of the load of recyclables.

Racks

Racks may be mounted into the side or rear of refuse collection vehicles to enable a crew to collect refuse and separated paper simultaneously. The most common type of rack is the side loading rack; it is the easiest to fabricate, install and load. Some municipalities, however, install overhead racks above the rear loading hoppers of refuse compactors because these racks generally have larger storage capacities and are easier to unload. Side racks are made of steel with doors to contain blowing paper.

Racks are relatively inexpensive to build and install and may be used by a community that wants to test the potential success of a curbside collection program without making a large capital investment. Racks have a small storage capacity, however, and they tend to fill with newspapers before the trucks fill up with garbage. Therefore, the recyclable material periodically has to be transferred to other collection vehicles or the truck must return to the drop-off site for unloading. Unloading racks into a passing truck takes only a few minutes while traveling to a site can add additional time to a collection trip. Another possible problem with racks is that they do not fit on all trucks.

Trailers

Trailers are being used by an increasing number of municipalities to collect one or more recyclables simultaneously or to collect one or more recyclables and refuse at the same time. They have a larger capacity than racks and can be compartmentalized to hold two or more recyclables separately. Trailers attached to collection vehicles can gather recyclables more economically than can a special vehicle or separate truck and crew. They are commercially available in a variety of sizes and designs. Trailers also may be built or modified by a municipality at low cost. They cannot, however, be used in municipalities that have steep hills, many alleys, cul-de-sacs, or severe winters because of maneuvering problems. In addition, trailers that force collectors to step over a tow bar can be dangerous.

Storage Containers

Most communities must store recyclable materials until they collect a sufficient quantity to transport to market. There are two basic types of storage containers: mobile and stationary. Mobile containers can haul materials directly to market; they are either pulled by or placed on a vehicle. Stationary containers cannot be moved; materials must be loaded from them and placed in another container or vehicle for transportation to market.

Mobile Containers

Mobile containers include roll-off containers, refuse transfer trailers, lugger boxes, 55-gallon drums and other open top containers. Of these, the most efficient are roll-off containers and transfer trailers, which have greater capacities than a single-collection

vehicle. Mobile containers are commercially available. Commonly used for refuse operations, they may often be acquired from municipalities and private sanitation companies as spare containers. They can be loaded manually or with a front-end loader.

Roll-off containers are available in a variety of sizes and may be compartmentalized to hold more than one recyclable material. Once full, the containers are pulled onto the roll-off truck by a winch or hydraulic cylinder and transported to the market.

Refuse transfer trailers are used to store and haul a single material, most commonly newspaper or mixed waste paper, to market. The material may be loaded manually or by a hopper positioned above the transfer trailer. Either the hopper or the trailer contains a hydraulic ram that compacts the materials. The compactor ram unloads the trailer by pushing materials out of the body. Trailers are more expensive than roll-off containers, but they have a larger storage capacity.

Containers such as lugger boxes, 55-gallon drums and other open-top containers can be used to store materials temporarily. These units can be filled and unloaded manually or mechanically. Containers such as these are used to hold only one material.

Stationary Bins

Containers such as wooden or steel boxes or cement bins can be used to store one or more materials at a central facility. Stationary containers used at recycling centers may serve the dual purpose of receiving and storing materials. They can be filled manually or mechanically and emptied by a front-end loader that transfers the materials to a hauling vehicle. Although manufactured bins may be used, most programs build their own stationary containers with existing labor and materials. Disadvantages of this storage system are that additional handling of the materials is required for hauling and the bins are not watertight.

Recycling Equipment Guides

An Evaluation of Processing Methods and Equipment For Use By Multi-Material Recycling Centers (March 1981)/ Cal Recovery Systems, Inc.; 160 Broadway; Suite 200; Richmond, CA 94804/ (415) 232-3066

Source Separation Collection and Processing Equipment, A User's Guide SW-842 (1980)/ Office of Solid Waste Management; U.S. EPA, 401 M. Street SW; Washington, DC 20460/ (800) 424-9346

Source Separation Collection and Processing Equipment, A Final Report SW-192C (Jan. 1981)/ Office of Solid Waste Management; U.S. EPA, 401 M. Street, Washington, DC 20460/ (800) 424-9346

Manufacturers and Supplies

Recycling Equipment Companies

A. Refuse Containers

Accurate Industries, Inc.
Williamstown, New Jersey

American Environment Products
Sewell, New Jersey

Capital Industries. Inc.
Seattle, Washington

Cobey Waste Control
Gallion, Ohio

County Plastics Corp.
North Babylon, New York

Crown Rotational Molded Products, Inc.
Marked Tree, Arkansas

Dempster Dumpster Systems
Knoxville, Tennessee

DeWald, Northwest
Albany, Oregon

Duncan Equipment, Inc.
South Arlington, Texas

Galbreth, Inc.
Winamac, Indiana

Marathon Equipment Company
Vernon, Alabama

Paker Industries, Inc.
Silver Lake, Indiana

Peabody Solid Waste Management
Gallion, Ohio

P.P.I. Industries
Goddard, Kansas

Quality Steel Fabricators, Inc.
Hopkins, Michigan

Rayfo, Inc.
Rosemont, Minnesota

Rubbermaid Applied Products, Inc.
Statesville, North Carolina

SCI Equipment Corp.
Commack, New York

Scott and Hill Steel Corp.
Bartlesville, Oklahoma

Teem Enterprises, Inc.
Sioux Falls, South Dakota

The Heil Company
Chattanooga, Tennessee

Tri-Pak Systems Company
Louisville, Kentucky

Universal Handling Equipment
Company Limited
Hamilton, Ontario, Canada

Zarn, Inc.
Reidsville, North Carolina

B. Trucks

Broyhill Manufacturing Company
Dakota City, Nebraska

Cobey Waste Control
Gallion, Ohio

Crane Carrier Company
Tulsa, Oklahoma

Drew-It Corporation
Hampton, New Hampshire

Duncan Equipment, Inc.
South Arlington, Texas

Ebeling Manufacturing Corporation
Plainview, Texas

Elgin-Leach Corporation
Chicago, Illinois

Ford Division - Ford Motor Company
Detroit, Michigan

GMC Truck
Pontiac, Michigan

Mercedes-Benz of North America
Montvale, New Jersey

International Harvester Truck Group
Chicago, Illinois

Iveco Trucks of North America, Inc.
Blue Bell, Pennsylvania

LoDal, Inc.
Kingsford, Michigan

Mack Trucks, Inc.
Allentown, Pennsylvania

Maxon Industries, Inc.
Commerce, California

Pak-Mor Manufacturing Company
San Antonio, Texas

Peabody Solid Wastes Management
Gallion, Ohio

Recycling and Conservation, Inc.
Kittery, Maine

Shu Pak
City of Commerce, California

The Heil Company
Milwaukee, Wisconsin

Truxmore Industries, Inc.
Richmond, Virginia

Wayne Engineering Corporation
Cedar Falls, Iowa

C. Balers

Accurate Industries
Williamstown, New Jersey

American Baler
Bellevue, Ohio

American Designed Products
Wayne, Pennsylvania

American Environmental Products Company
Baton Rouge, Louisiana

American Hoist & Derrick
St. Paul, Minnesota

Balemaster
East Chicago, Indiana

Consolidated Bailing Machine
Brooklyn, New York

Economy-Lake Baler Division; Enterprise Company
Santa Ana, California

Hesston Corp.
Jacksonville, Florida

International Baler Corporation
Jacksonville, Florida

Logemann Brother Company
Milwaukee, Wisconsin

Marathon Equipment Company
Vernon, Alabama

McClain Industries
Utica, Michigan

National Baling Press Company, Inc.
Brooklyn, New York

National Compactor
& Technology Systems, Inc.
Jacksonville, Florida

Newell Manufacturing Company
San Antonio, Texas

Peabody Solid Waste Management
Gallion, Ohio

Philadelphia Tramrail Company
Philadelphia, Pennsylvania

Union Environment Corp.
Old Forge, Pennsylvania

D. Collection Trailers

Gladco Compactors, Inc.
Taylor, Michigan

Midway Fishing Tool Company
Bakersville, California

Northern Truck Equipment Company
East Hartford, Connecticut

Swacars
Valdosta, Georgia

E. Other Collection Vehicles

Cushman/OMC-Lincoln
Lincoln, Nebraska

F. Transfer Trailers

American Carrier Equipment Company
Fresno, California

Anchorpac
Jackson, Michigan

Dempster Dumpster Systems
Knoxville, Tennessee

LoDal, Inc.
Kingsford, Michigan

McClain Industries
Sterling Heights, Michigan

Pak-Mor Manufacturing
San Antonio, Texas

Peabody
Gallion, Ohio

Steco Sales, Inc.
Pottsville, Pennsylvania

The Heil Company
Chattanooga, Tennessee

Tri-Pak Systems Company
Louisville, Kentucky

Universal Handling Equipment Company
Hamilton, Ontario, Canada

G. Processing Equipment (General)

CP Manufacturing Inc.
National City, California

Drew-It Corporation
Hampton, New Hampshire

J.A. Freeman and Sons
Portland, Oregon

Miller Manufacturing - United Farm Tools, In
Turlock, California

Newell Manufacturing
San Antonio, Texas

Resource Recovery Systems, Inc.
Branford, Connecticut

Triple/S Dynamics, Inc.
Dallas, Texas

H. Conveyors

Allis Chalmers
Milwaukee, Wisconsin

Barber-Green
Aurora, Illinois

Beaumont Birch Company
Pennsauken, New Jersey

Better Machines, Inc.
Fantaintown, Indiana

Bonded Scale Machine Company
Columbus, Ohio

Fairfield Engineering Company
Marion, Ohio

FEECO International Corp.
Green Bay, Wisconsin

FMC Corporation
Colman, Pennsylvania

General Conveyor Company, Inc.
Long Island City, New York

General Kinematics Corporation
Berrington, Illinois

Gruendler Crusher & Pulverizer Company
St. Louis, Missouri

Hammermills
Cedar Raids, Iowa

Heil Company
Milwaukee, Wisconsin

Jeffrey Manufacturing Division, Dresser Industries
Columbus, Ohio

Link Belt Company
Honer City, Pennsylvania

Mayfran, Inc.
Cleveland, Ohio

Montgomery Industries, Inc.
Jacksonville, Florida

Rexnord, Inc.
Milwaukee, Wisconsin

Rust Engineering, Inc.
Birmingham, Alabama

Stephens-Adamson
Aurora, Illinois

Triple/S Dynamics Systems, Inc.
Dallas, Texas

Williams Patent Crusher & Pulverizer Company
St. Louis, Missouri

I. Shredders

American Pulverizer
St. Louis, Missouri

Iowa Manufacturing Company
Cedar Rapids, Iowa

Miller Manufacturing
Turlock, California

Newell Manufacturing Company
San Antonio, Texas

Pennsylvania Crusher
Broomall, Pennsylvania

Saturn Shredders
Wilsonville, Oregon

Shred-Tech, Inc.
Cocoa, Florida

Williams Crusher and Pulverizer
St. Louis, Missouri

J. Scales

Cardinal Scale Manufacturing Company
Webb City, Missouri

Eldec Corporation
Lynwood, Washington

Fairbanks Weighing Division-Colt Industries
St. Johnsburg, Vermont

Howe Richardson Scale
Clifton, New Jersey

Streeter-Amet
Grayslake, Illinois

Toledo Scale
Worthington, Ohio

K. Magnetic Separators

American Pulverizer
St. Louis, Missouri

Dings Company
Milwaukee, Wisconsin

Eriez Magnetics
Erie, Pennsylvania

Martin Podren, Inc.
Lynn, Massachusetts

McNally Pittsburg Corporation
Pittsburg, Kansas

Roberts & Schaefer, Inc.
Rolling Meadows, Illinois

Shred-Tech, Inc.
Cocoa, Florida

Stearns Magnetics
Cudahy, Wisconsin

Wemco Division, Envirotech Corporation
Sacramento, California

L. Glass Crushers

American Pulverizer
St. Louis, Missouri

Central Steel Contractors
Kaukauna, Wisconsin

Cleveland Range Company
Cleveland, Ohio

Columbia Machine
Vancouver, Washington

Franklin Miller, Inc.
East Orange, New Jersey

Greundler Crusher
St. Louis, Missouri

Heil Company
Milwaukee, Wisconsin

Jacobsen Machine Works
Minneapolis, Minnesota

Jeffrey Manufacturing
Columbus, Ohio

Pennsylvania Crusher
Broomall, Pennsylvania

Qualheim, Inc.
Racine, Wisconsin

Rescor Industries
Mt. Vernon, New York

Snyder Machine
Saugas, Massachusetts

Syrall Manufacturing
Syracuse, New York

Williams Patent Crusher
St. Louis, Missouri

APPENDIX IV
ORGANIZATIONS INVOLVED IN RECYCLING*

State Recycling Associations

Alaska

Alaska Recyclers Association
5650 Camelot Drive
Anchorage, Alaska 99508

California

California Resource Recovery Assoc.
125 W. Swift Avenue
Clovis, California 93612
(209) 292-3247

Colorado

Colorado Recycling Cooperative Assoc.
P. O. Box 4193
Boulder, Colorado 80306
(303) 444-6634

Illinois

Illinois Assoc. of Recycling Centers
P. O. Box 48761
Chicago, Illinois 60648
(312) 470-0242 or (312) 769-6677

Michigan

Michigan Recycling Coalition
P. O. Box 48107
Ann Arbor, Michigan 48107
(313) 665-6398

Minnesota

Recycling Assoc. of Minnesota
P. O. Box 30632
St. Paul, Minnesota 55175
(612) 646-2591

Nebraska

Nebraska State Recycling Assoc.
Route 2, Box 423
Kearny, Nebraska 68847
(308) 237-7339

New Hampshire

New Hampshire Resource Recovery Assoc.
P. O. Box 472
Concord, New Hampshire 03301

New Jersey

New Jersey Recycling Forum
Park 80 Plaza West 1
Saddle Brook, New Jersey 07662
(201) 843-1450

Ohio

Federation of Ohio Recyclers
2801 Far Hills Avenue
Dayton, Ohio 45419
(513) 294-8080

Oregon

Association of Oregon Recyclers
P. O. Box 10051
Portland, Oregon 97210
(503) 228-5375 or (503) 227-1326

Pennsylvania

Group for Recycling in Pennsylvania
P. O. Box 7391
Pittsburgh, Pennsylvania 15213
(412) 661-4447

Vermont

Association of Vermont Recyclers
P. O. Box 965
Rutland, Vermont 05701
(802) 775-6482

Washington

Washington Citizens for Recycling
Curtis Chapman Express
P. O. Box 2449
Seattle, Washington 98111
(206) 621-8218

Washington State Recycling Assoc.
P. O. Box 569
Seattle, Washington 98111
(206) 363-8433

Wisconsin

Wisconsin Coalition for Recycling
111 King Street, Room 31-32
Madison, Wisconsin 53703
(608) 256-0565

Trade Associations of Industries Which Process or Use Recycled Materials

Aluminum Association
818 Connecticut Ave., N.W.
Washington, DC 20006
(202) 862-5100

Aluminum Recycling Association
900 17th St., N.W.
Washington, DC 20006
(202) 785-0559

American Iron & Steel Institute
1000 16th St., N.W.
Washington, DC 20036
(202) 452-7100

American Paper Institute
260 Madison Avenue
New York, NY 10016

American Retreaders Association
P. O. Box 17203
Louisville, KY 40217

Association of Petroleum Re-refiners
Suite 1111
2024 Pennsylvania Avenue
Washington, DC 20006
(202) 833-2694

Automotive Dismantlers
& Recyclers of America
1000 Vermont Ave. N.W.
Washington, DC 20005
(202) 628-4634

Can Manufacturers Institute, Inc.
821 15th St., N.W.
Washington, DC 20005
(202) 232-4677

Copper & Brass Fabricators Council
Suite 440
1050 17th St., N.W.
Washington, DC 20036

Fibre Box Association
5725 East River Road
Chicago, IL 60631

Glass Packaging Institute
1800 K. St., N.W.
Washington, DC 20006
(202) 872-1280

Institute of Scrap Iron & Steel
1627 K. St., N.W.
Washington, DC 20006
(202) 466-4050

National Assoc. of Recycling Industries
330 Madison Avenue
New York, NY 10017
(212) 867-7330

National Association of Solvent Recyclers
1406 Third National Bldg.
Dayton, OH 45402
(513) 223-0419

National Association of
Wiping Cloth Manufacturing
189 W. Madison Street
Chicago, IL 60602
(312) 726-0050

National Textile Processors Guild, Inc.
51 Chambers Street
New York, NY 10007
(212) 962-1183

National Tire Dealers
& Retreaders Association
1343 L. Street, N.W.
Washington, DC 20005
(202) 638-6650

Paperboard Packaging Council
1800 K. Street, N.W.
Suite 600
Washington, DC 20006
(202) 872-0180

Rubber Manufacturers Association
1901 Pennsylvania Ave., N.W.
Washington, DC 20006

Society of the Plastics Industry, Inc.
355 Lexington Avenue
New York, NY 10017

Solid Waste Council of the Paper Industry
1619 Massachusetts Ave., N.W.
Washington, DC 20036
(202) 797-5786

Technical Association of Pulp
& Paper Industries
One Dunwoody Park
Chamblee, GA 30341
(404) 394-6130

Textile Fibers & By-Products Association
144 Brevard Court
Charlotte, NC 28201

Tire Retread Information Bureau
P. O. Box 811
Pebble Beach, CA 93953

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* Information, courtesy of National Recycling Coalition Inc., 45 Rockefeller Plaza, Room 2350, New York, New York 10020, (212) 765-1054

APPENDIX V
KEEP AMERICA BEAUTIFUL MEMBERS

Appendix V

Keep America Beautiful, Inc. Members and Contributors

Aluminum Company of America
American Can Company
American Iron & Steel Institute
American Paper Institute, Inc.
Amoco Foam Products Company
Anchor Hocking Corporation
Anheuser-Busch Companies
Atlantic Richfield Company
Ball Corporation
Bethlehem Steel Corporation
Alfred Bleyer & Co., Inc.
Brockway Glass Company
Brooklyn Lace Paper Works, Inc.
Browning-Ferris Industries, Inc.
Burger King Corporation
Burlington Industries Foundation
Calgon Corporation
Campbell Soup Company
Certified Grocers of Ca. Ltd.
Champion International
Chemical Bank
Chesapeake Corporation of Virginia
Chevron U.S.A. Inc.
Cigna Corporation
Coca-Cola Company, The
Conoco, Inc.
Container Corporation of America
Continental Group, Inc., The
Cook Paint & Varnish Company
CPC International Inc.
Crown Cork & Seal Company
Dewey & Almy Chemical Div. W. R. Grace
Dexter Corporation, The
Diamond Glass Company
Diamond International Corporation
Dolco Packaging
Dow Chemical U.S.A.
Dr Pepper Company
Duquesne Light Company
Emhart Corporation
FECO, A Bangor Punta Company
Federal Paper Board Company
Ford Motor Company
Formpac Div. W. R. Grace & Co.
Garden State Paper Company, Inc.
Glass Containers Corporation
Glass, Pottery, Plastics and Allied Workers
Glidden Coatings & Resins, Div. SCM Corp.
Green Bay Packaging Inc.
Hammermill Paper Company
H. J. Heinz Company
Hershey Foods Corporation
Hiram Walker & Sons, Inc.
Hollingsworth & Vose Company
Illinois Tool Works, Inc.
Independent Steelworkers Union
Inland Container Corporation
Inmont Corporation
International Business Machines Corporation
International Sanitary Supply Association
James River Corporation
Jones & Laughlin Steel Corporation
Joyce Beverage Inc.
Kaiser Aluminum & Chemical Corporation
Kerr Glass Manufacturing Corporation
Kroger Company, The
Latchford Glass Company
Liberty Glass Company
Lipton, Inc., Thomas J.
Longview Fibre Company
Ludlow Corporation
Mead Packaging
Menasha Corporation
Merchants Distributors, Inc.
Midland Glass Company, Inc.
Mobil Foundation, Inc.
Monadnock Paper Mills Inc.
Moore, Benjamin & Co.
Nabisco Brands USA
National Can Corporation
National Car Rental Service System
National Soft Drink Association

National Starch & Chemical Corporation
National Steel Corporation
Noteworthy Company, The
Nyman Manufacturing Company
Occidental Petroleum Corporation
Owens-Illinois, Inc.
Packaging Corporation of America
Paperboard Packaging Council
Penntech Papers, Inc.
Pepsi-Cola Company
Philip Morris Incorporated
Premier Industries Incorporated
Procter & Gamble Company, The
Publix Super Markets, Inc.
Redicon Corporation
Reynolds Metals Company
R. J. Reynolds Industries, Inc.
Roundy's Inc.
Royal Crown Cola Company
St. Regis Paper Company
Sealright Co., Inc.
Seven-Up Company, The
Society of the Plastics Industry, Inc., The
Southeast Paper Manufacturing Co.
Stone, Glass & Clay Coordinating Co.
Sullivan Paper Company, Inc.
Super Food Services, Inc.
Sweetheart Cup
Thatcher Glass Manufacturing Co.
Thriftimart, Inc.
Time, Inc.
Union Camp Corporation
United States Steel Corporation
United Steelworkers of America
Western Electric
Westvaco
Wetterau Incorporated
Wheelabrator-Frye Inc.
Wheeling-Pittsburgh Steel Corporation
White Castle System, Inc.
Willamette Industries Inc.
Wm. Wrigley Jr. Company

APPENDIX VI
CLEAN COMMUNITY SYSTEM

Appendix VI

Clean Community System

CCS applies the techniques of behavioral science to changing personal attitudes about handling solid waste.

CCS research found that:

Loose trash comes from from seven sources:

- household refuse putouts
- commercial refuse putouts
- construction/demolition sites
- uncovered vehicles
- loading docks
- motorists
- pedestrians

Three attitudes predominate most people's thinking about handling waste. They feel it's "o.k." to litter:

- where they feel no sense of ownership for the property
- where someone else will clean up after them
- where trash has already accumulated

Once a community has committed itself to CCS implementation, a "Clean City Committee" representing business, labor, government, the media, schools, civic groups and youth organizations applies a "normative system change process" to change attitudes about handling waste. Each CCS city applies this sequence.

- get the facts
- involve the people
- develop a systematic approach
- focus on results
- provide positive reinforcement

to the four CCS components:

- updated waste-handling ordinances
- improved santitation technology
- consistent public education
- consistent enforcement

Through twice-annual Photometric Indices (a photographic process quantifying changes in litter levels), reductions are measured the areas requiring special programs are identified.

Once CCS programs become established, many develop recycling programs as well. CCS has also been adapted to address other community concerns, such as energy conservation and changes in sanitation department trash collection practices.

A CCS Cost/Benefit Analysis undertaken in 1982 showed that, for every municipal dollar invested in the CCS, communities received from $2 - $110 community benefits. These benefits were due to city budget reductions, avoidance of municipal funding of programs which could be carried out by volunteers, income from recovered materials and the donation of volunteer time, goods and services.

Further information on the CCS and the Cost/Benefit Analysis may be secured from:

Keep America Beautiful, Inc.
99 Park Avenue
New York, New York 10016